FURTHER RESEARCH AND CONTROL OF SEA LAMPREYS OF THE GREAT LAKES AREA

HEARINGS

BEFORE THE

SUBCOMMITTEE ON THE FISHERIES AND WILDLIFE CONSERVATION

OF THE

COMMITTEE ON MERCHANT MARINE AND FISHERIES HOUSE OF REPRESENTATIVES

EIGHTY-SECOND CONGRESS

SECOND SESSION

Pursuant to H. Rept. 558, 82d Cong., 1st sess.,
which accompanies H. R. 2995

REPORT OF THE FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR, ON THE SEA LAMPREY PROBLEM AND DISCUSSION OF FUTURE PLANS, PROCEDURES, AND ESTIMATES OF COST

FEBRUARY 5, 1952

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FURTHER RESEARCH AND CONTROL OF SEA LAMPREYS OF THE GREAT LAKES AREA

TUESDAY, FEBRUARY 5, 1952

HOUSE OF REPRESENTATIVES,
SUBMITTEE ON FISHERIES AND
WILDLIFE CONSERVATION OF THE
COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
Washington, D. C.

The committee met, pursuant to notice, at 10 a. m., in the committee hearing room, 219 Old House Office Building, the Honorable Frank W. Boykin (chairman of the subcommittee) presiding.

Present: Representatives Boykin, Bonner, Bennett, Robeson, Allen, Weichel, and Tollefson.

Also present: Representative Potter and Representative Church.

The CHAIRMAN. Well, gentlemen, we will come to order.

Congressman Potter is here and he has another meeting and he would like to make an opening statement, so we will be glad to hear from you, Congressman Potter.

STATEMENT OF HON. CHARLES E. POTTER, MEMBER OF CONGRESS FROM THE ELEVENTH DISTRICT OF MICHIGAN

Mr. POTTER. Mr. Chairman, needless to say, I am most appreciative of your action in calling this meeting at an early date. You recall last year when this matter was under consideration it was recommended by the committee that the Fish and Wildlife Service should report to you early this year and give a progress report, and that the authorization which we originally requested be over a 5-year period should be only for a 1-year period to allow the Fish and Wildlife Service to make their recommendations.

Now, we had last year, as you will probably recall, some difficulty due to the fact that the Appropriations Committee had acted before we secured the approval of the authorization, which made it necessary for us to secure funds through a supplemental appropriation bill. That impeded the work to some extent but I am happy to report, Mr. Chairman, that the Fish and Wildlife Service has done a magnificent job, in my opinion. They are on the final wind-up of the research phase. I am sure that other witnesses will tell you more about that later on, and they are in a position to recommend control procedures.

I don't intend to bore you with the problem of the sea lamprey in our Great Lakes. You are familiar with it from past testimony. We have here technical people who are much more adept and have much more information on the subject than I but I do think it important,

Mr. Chairman, that you know my reaction to a Government agency which has been working in any area prior to the time that Dr. Moffett and his men went in there and took charge of the Great Lakes fishery program.

The relationship between commercial fishermen and the Fish and Wildlife Service, to say the least, was not good. Dr. Moffett and the men who are identified with him not only have done a good job in their research program but they have done it in such a way that they have the complete confidence of commercial fishermen and other interested people in the area, which I think is very important.

You will hear from Mr. Claude Ver Duin who represents the Fish Producers Association and who will explain that relationship much better than I.

Now, I don't want to take any more time, Mr. Chairman, but I do know I believe you will find they will be asking for an authorization for $446,000 for this next year. This will complete the research program.

If the money that has been spent in the past is to mean anything it will be necessary to carry out and finish the program this year then, the States, in conjunction with the Federal Government, will have to agree on whatever control means will be devised, and who will have to carry the ball from there on. But the research program is at the end of the line and this is what will bring it to its conclusion, and once again I wish to say that they have done, in my opinion, a remarkable job. This is one research program that is coming to an end.

Thank you, Mr. Chairman.

Mr. BOYKIN. Thank you.

Mr. POTTER. And Dr. Moffett will be in charge of the other witnesses, Mr. Chairman.

Mr. ALLEN. I have a question, Mr. Chairman.

Mr. BOYKIN. Mr. Allen.

Mr. ALLEN. Mr. Potter, have you heard any discussions in the area by the people with whom you are in contact as to whether the program is being carried out in an efficient and economical manner and without having too many people around to do the job?

Mr. POTTER. Yes, sir. I wish to report not only has it been done in an economic manner but that most of the people who have been working on this program have put in time way over and above the time that the normal civil service employee is required to put in. This is done without overtime or any other consideration. These men, I have found in my experience, are interested in the job of research and they have done it without consideration of time and effort on their parts and I am pleased to note that it has been done by the type of people they have working for them, scientists, who can go out in any other field of endeavor and probably earn considerably more money, have worked on this program at moderate salaries and worked long periods of time which are over and above their actual call to duty.

Mr. ALLEN. Is there any indication that there is too much time put into research in laboratories rather than in field work?

Mr. POTTER. No. I should think the opposite. As you know, I have seen research programs that have come before Congress in the past and you have known they cost a considerable amount of money. When you stop to realize that they have been operating on this pro-

gram covering a large area of the southern part of Lake Superior and part of Lake Huron and Lake Michigan, and this has been done—I don't have the figures as to the number of people that have been employed but it has been a minimum number of people, as will be testified by the funds they have had to work with.

Mr. BOYKIN. Are there any other questions, gentlemen? Mr. Weichel?

Mr. WEICHEL. No.

Mr. BOYKIN. Thank you very much. Now we would like to hear from Dr. Moffett. I am sorry Mr. Albert M. Day is not here but I understand Dr. Moffett is going to give us the information we need.

STATEMENT OF DR. JAMES W. MOFFETT, CHIEF, GREAT LAKES FISHERY INVESTIGATIONS, FISH AND WILDLIFE SERVICE, ANN ARBOR, MICH.

Dr. MOFFETT. Gentlemen, it is a pleasure to appear before you again and to report, in essence, what we have accomplished since our last meeting, and in accordance with your directive we intend to show you the results which we have obtained.

I would like to ask Mr. William Terry of the Fish and Wildlife Service to read a statement prepared by Mr. Albert M. Day, Director of the Fish and Wildlife Service, who was not able to attend this hearing because of a commitment in the Senate.

Mr. WEICHEL. Mr. Chairman, is Mr. Day ever going to come up here? Is he coming up today? I haven't seen him around here for a year and I was wondering if he would be here today.

Mr. BOYKIN. Frances tells me he is going to a hearing on the tuna tariff in the Finance Committee of the Senate.

Now, I understand that the statement that Mr. Albert Day, the Director, was going to make will be given to us by Mr. William Terry of the Fish and Wildlife Service. But I will tell you what we will do, Mr. Weichel. This is his statement but I will be glad to get him up here at a special meeting. But this is his statement. Mr. William Terry.

STATEMENT OF ALBERT M. DAY, DIRECTOR, FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR; READ BY WILLIAM TERRY, FISH AND WILDLIFE SERVICE

Mr. TERRY. My name is William Terry. I am in the Foreign Relations Office of the Fish and Wildlife Service and I have been asked to read Mr. Day's prepared statement. With your permission I will do so now.

Mr. Chairman and members of the committee, we feel complimented that you have seen fit to call us before you at this time for the purpose of hearing the results of our research on sea lamprey control methods since our last meeting on April 30, 1951. As directed by your committee in House Report No. 558 on H. R. 2995, Eighty-second Congress, first session, which was approved July 30, 1951, as Public Law 94, the Fish and Wildlife Service is prepared to report the salient features of our progress. We hope to present also a detailed projection of plans, procedures, and estimates of cost for the future. It is our sin-

cere trust that you, gentlemen, will find further authorization justified and that you will enable the Service to carry to conclusion the research and development believed necessary to complete our assigned task.

I presume that you may wish to hear the details of our findings and our future program from representatives of the group which constitutes our Great Lakes fishery investigation in the field. Such was your pleasure at the last hearing. I believe your sound judgment brought forth a satisfactory treatment of this very serious problem in Great Lakes fisheries. Hence, I shall speak briefly of the main points in the program which have come to light since our last hearing.

As you know, the Service received its regular appropriation late in September instead of July 1, and the uncertainties of limitations and reductions made it quite impracticable to proceed with work normally until October. The supplemental appropriation made as the result of Public Law 94 was not available for use until late November. However, the yield of research is often very rapid, once the trends become clear and a certain measure of success has been achieved.

Shortly after the hearing of April 30, 1951, experimental installations designed to yield information on basic principles of sea-lamprey control began to show results. Two of several electrical devices offered great promise. Subsequent developments lead us to make the optimistic statement that we have found a means, both feasible and economical, for control of the sea lamprey.

These preliminary experiments demonstrated that we can stop all of the upstream migration of adult sea lampreys in streams now used by this parasite. Once installations are made the cost of power to operate one of these devices is practically nothing. The one experimental device was used in a 90-foot stream and operated very successfully on as little as 2 kilowatts of electrical power. In terms of the rates now existing in northern Michigan this power requirement will cost 5 cents to 10 cents per hour. Dr. James Moffett and his staff will, undoubtedly, present to you the details of this procedure.

We see in this new development the possibility of placing under control a great many streams in which control by other known procedures would have required large capital outlays and fairly large maintenance and operational costs. The electrical device will provide a definite stream block without the objectionable feature inherent in mechanical structures. The ability to pass debris, leaves, logs, and floods without blocking the stream makes this electrical approach one of great promise. Formerly, a weir in the Ocqueoc River of northern Michigan, where this experimentation was done, required a crew of four men to keep it in operating condition. At times of flood this crew had to be augmented by an additional two men. Even then, the weir repeatedly was threatened with destruction by accumulation of debris and large heads of water. The electrical device allows such materials to pass unhindered downstream. No cleaning, except possible removal of large limbs, seems necessary in the use of the electrical device.

It must have occurred to you that such optimistic findings must have a disadvantage somewhere. One of the major problems remaining to be solved concerns associated fishes. Sea lampreys, many suckers, and some of the game fishes migrating upstream are all affected by the electrical current. Our preliminary observations show that many

of the game fishes veer away from the electrical pattern before harm comes to them. Their behavior is such that they can be guided, by diagonally placed electrical areas, into a shielded trap at the upstream end of the diagonal. Suckers, however, do not display such a leading behavior. They and the sea lamprey bore headlong into the electrical field until they are rendered unconscious and fall to the bottom. If they remain in the electrical field for a rather long time both the sea lampreys and suckers are killed. We are now working on an electrical equipment which is believed capable of leading fishes in certain directions. If these experiments turn out successfully we will have solved the problem of caring for associated fish species.

One of the other electrical devices makes application of a principle developed by Mr. Henry T. Burkey of the Electric Fish Screen Co. The Burkey device develops a pulsed, high-voltage, direct current which, when introduced into water, has a narcotizing effect on fishes and sea lampreys. Our experiments with this type of electrical barrier were not conclusive but this device shows definite promise. There is some hint that this pulsed, high-voltage, direct current will have a selective action; that is, may block lampreys but at the same time permit the passage of fish. The principle needs further experimentation and development before additional information can be released.

The fact that the Service has found these principles does not permit us to say that the problem is solved. As you will hear subsequently there is a large amount of work yet to be done in the development of these principles and in the engineering and biological problems associated with the use of such devices. A major aspect of our future program will be the development of these principles to a point where practical application is possible.

In cooperation with our staff the State of Michigan built and operated a barrier dam which has proven capable of blocking sea lampreys while providing upstream access to such fishes as rainbow trout. This barrier dam consists essentially of a low-head dam equipped with an adjustable steel lip which is curved in an arc downstream. Sea lampreys attempting to move over the dam cannot make progress because they are caught under the curved lip and cannot proceed further. This barrier dam was very successful in the spring of 1951, and it can be used in a great many of the streams tributary to the Great Lakes. A most important feature of the barrier dam is that it requires little or no maintenance.

Even with these optimistic findings the Service feels cautious in its approach to the possibility of actual control. Naturally, our concern regarding the cost is somewhat relieved, but we still face the problem of expedition. One of our major tasks is the planning of an organization which can carry out sea lamprey control at a level where reduction in the numbers of these parasites can be reliably expected. I refer here to the problem which I brought before you in our previous hearing. Our researches are highly promising and will lead to more or less detailed recommendations for the reduction of the threat of the sea lamprey. The operations will cost money, and the issue of responsibility for this work still remains to be clarified. Solution of this problem appears more and more necessary and approaches being an emergency if we wish to expedite control and make it an actuality within the next 2 years.

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As I have said before, I think one portion of the problem is crystal clear. There must be some degree of Federal participation in the work on the Great Lakes because of the international character of the waters. Sea lampreys do not respect international boundaries, and the problem of their control is as great in Canada is it is in the United States. Our people have learned that the sea lamprey does not "home" to any particular stream for spawning and, therefore, control must be done in large units. It does not seem wise for us to plan on control of lampreys in our Territorial waters if a similar effort is not put forth by our Canadian neighbors.

The problem of State participation in any control program must be decided. I am happy to report that the States concerned with this sea lamprey problem are willing to enter into any reasonable cooperative activity involving control. I presume you will hear opinions from representatives of these States and I shall not encroach further on their testimony.

The urgency of setting up a practical control program with the least possible delay grows rapidly with the passage of time. The most recent statistics on lake-trout production do nothing to lighten the gloomy picture drawn for you last year. Preliminary figures show the 1951 production in the United States waters of Lake Huron to have been less than a hundred pounds, and indicate that in Lake Michigan, which yielded above 6 million pounds as recently as 1944 the 1951 take may have been less than 10,000 pounds. We can afford no delays if the single remaining lake-trout fishery, that of Lake Superior, is to be saved and the once rich fisheries of Lake Huron and Michigan are to be rehabilitated. The State is large. Annual losses to the industry already run into millions of dollars and will become even greater if vigorous action is not taken.

In conclusion I would like to emphasize that the Fish and Wildlife Service has gone at this sea-lamprey control program with vigor and with boundless enthusiasm. All of us have been confident of success, and I know that members of the Great Lakes fishery investigation staff have been unstinted in their devotion to the advancement of the work. Many of the men on that staff have devoted much more of their time and energy to the problem than duty required merely because they felt the true importance of saving the industry.

Unless there are other questions I should like now to relinquish the witness stand to other witnesses whom your chairman might wish to call.

Mr. BOYKIN. Are there any questions, gentlemen?

Mr. ALLEN. Mr. Terry, what is your position at the Fish and Wildlife Service?

Mr. TERRY. I am a member of the Office of Foreign Activities.

Mr. ALLEN. I had hoped to ask Mr. Day to discuss very briefly the other investigations which the Service is interested in and a little bit about the relative costs and the relative benefits, to get the whole program into some perspective. What I had in mind particularly was I have been down to San Diego and have seen a little bit of the work that is being done by the Inter-American Tuna Commission and there they have an industry which has an annual yield of something over $112,000,000, I believe, and they feel they may lose it because of a lack of something like $150,000 to $300,000 a year of appropriation.

Over in Honolulu they have a Pacific Ocean investigation where I believe they are spending somewhere in the neighborhood of three-quarters of a million dollars a year, and as far as I know this committee has had no appraisal of the progress or the probable result.

There have been a number of investigations authorized over on the east coast and the Gulf coast but as far as I remember in the past 3 or 4 years we have never had a discussion of the whole program under investigation, which would give us some indication as to whether we are spending the proper amount of money for the various endeavors or whether the Bureau is putting in the time in relation to the relative importance of the problem.

Are you prepared to discuss any question of general policy like that?

Mr. TERRY. I understand the question, but I feel hardly competent to discuss it. Perhaps some of the subsequent witnesses can answer various parts of this in the establishment of this investigation.

Mr. ALLEN. Will you tell Mr. Day I have been asking about that?

Mr. TERRY. I will do that.

Mr. WEICHEL. Mr. Chairman.

Mr. BOYKIN. Mr. Weichel.

Mr. WEICHEL. Mr. Terry, when did they start spending all this, in 1948?

Mr. TERRY. If I may, I would like to have some of the other witnesses testify. They are more competent.

Mr. WEICHEL. Do you know anything about this outside of reading it?

Mr. TERRY. Yes, but I am not technically competent to speak on the investigation phase of the program. My interest has been in another field.

Mr. WEICHEL. Do you know how many years have been spent in investigating the situation? Is that technical?

Mr. TERRY. I believe the first appropriation was in 1948, for the Fish and Wildlife Service.

Mr. WEICHEL. How much was that?

Mr. TERRY. I don't know.

Mr. WEICHEL. Do you know how much it was in 1949?

Mr. TERRY. No; I don't.

Mr. WEICHEL. 1950?

Mr. TERRY. No.

Mr. WEICHEL. Do you know anything outside of reading this?

Mr. TERRY. You mean the——

Mr. WEICHEL. Yes, about this.

Mr. TERRY. Somewhat.

Mr. WEICHEL. What do you know?

Mr. TERRY. My work has been concerned with the phase of international relations.

Mr. WEICHEL. With reference to international relations, do these lampreys breed and spawn in the tributary streams to the Great Lakes?

Mr. TERRY. If I understand you, Congressman, in both the Canadian and United States side.

Mr. WEICHEL. I asked if they come and breed in the streams that are tributary to the Great Lakes.

Mr. TERRY. Yes, they do.

Mr. WEICHEL. What portion of the streams that are tributary to the Great Lakes are from the American side and what portion of the streams are tributary with reference to the Canadian side?

Mr. TERRY. I am sorry, I can't answer that question.

Mr. WEICHEL. Are there very few on the Canadian side that are tributary to the Great Lakes in which lampreys are breeding through spawning?

Mr. TERRY. I don't know.

Mr. WEICHEL. What is your phase of the international relations? What is your phase of this if you don't know anything about it?

Mr. TERRY. The Office of Foreign Activities is concerned, as far as the sea lamprey investigation is concerned, with the matter of formulating policies in connection with the obvious need for cooperation.

Mr. WEICHEL. You are working on the foreign policy before you understand the domestic phase; is that right?

Mr. TERRY. Well, the work is——

Mr. WEICHEL. How can you do that before you know anything about it on this side?

Mr. TERRY. The work is divided and we have a technical staff which is responsible for research.

Mr. WEICHEL. Was this authorization with reference to the foreign policy or was this with reference to doing something on the American side, technically, to find out? How many are in your department on this work about the public relations?

Mr. TERRY. We are not involved in public relations.

Mr. WEICHEL. You said you are with the public relations on this.

Mr. TERRY. No; foreign.

Mr. WEICHEL. Foreign relations?

Mr. TERRY. Yes, foreign relations.

Mr. WEICHEL. How many are engaged in the foreign relations end of this?

Mr. TERRY. In our office, working directly on this problem, two of us have been devoting some time to it.

Mr. WEICHEL. Some time?

Mr. TERRY. That is right.

Mr. WEICHEL. What sort of negotiations have you entered into on this?

Mr. TERRY. No formal negotiations with any other government.

Mr. WEICHEL. What has been going on in foreign relations? I am interested in that, because it is before you know anything about domestic policy. What are the foreign relations?

Mr. TERRY. We have this problem as pointed out in Mr. Day's paper, the lampreys do not "home" to any particular stream for spawning. They go, as far as I know, to streams tributary to the Great Lakes in the United States.

Mr. WEICHEL. That has been found out years ago. You didn't just find that out.

Mr. TERRY. That is true. The point I am trying to make is, there is a need for control on the Canadian side as well as the United States side of the Lakes.

Mr. WEICHEL. Everybody knew that a long time ago.

Mr. TERRY. That will probably make it necessary to negotiate with Canada. That requires the work of the Foreign Relations.

Mr. WEICHEL. You have been working on this for 5 years?

Mr. TERRY. I have not.

Mr. WEICHEL. Who has?

Mr. TERRY. The Office of Foreign Activities has, but I have not been with it that long. Undoubtedly the problem has been handled that long.

Mr. WEICHEL. What does the Office of Foreign Relations determine with reference to the money that is being spent on this before there is any domestic report or any other? What have they done and where have they gone?

Mr. TERRY. We have actually concluded nothing. As I said earlier we have not entered into any negotiations.

Mr. WEICHEL. What have you done, is what I want to know.

Mr. TERRY. We have made a study of the problem to establish the best type of international instrument to serve the purpose.

Mr. WEICHEL. International instrument to serve what purpose?

Mr. TERRY. To develop the international cooperation relative to the control of this.

Mr. WEICHEL. How much breeding is there over there of the lamprey?

Mr. TERRY. That is the problem. We don't know.

Mr. WEICHEL. You don't know?

Mr. TERRY. We have reason to believe there is some. We have reason to believe that control on the United States side, as pointed out in Mr. Day's testimony, would be possibly relatively ineffective without similar control on the Canadian side.

Mr. WEICHEL. What parts of Canada are along what lakes?

Mr. TERRY. Those are technical questions which I can't answer myself. The scientists——

Mr. WEICHEL. Without knowing what lakes and where they are, how can you start working on the foreign relations of it?

Mr. TERRY. We know, after all, there are four lakes primarily involved in the Great Lakes group, that there are several of extreme importance and others where the infestation of the lamprey is not so great.

Mr. WEICHEL. How much money for research has the Canadian Government spent on it and on what lakes?

Mr. TERRY. I can't vouch on the amount of funds. I know they have been working with more or less informal cooperation with the Fish and Wildlife staff and the State government staffs for a number of years; since, I believe, 1946.

Mr. WEICHEL. What have they done themselves?

Mr. TERRY. I think Dr. Moffett can probably give you a better answer than I can.

Mr. WEICHEL. What have they done in cooperation? That is in your field of foreign relations. What have they done?

Mr. TERRY. I don't quite understand.

Mr. WEICHEL. You say they have cooperated. What have they done?

Mr. TERRY. In the research program I mean, up in the Great Lakes area. They have been working with our people in informal cooperation. In other words, conducting similar research.

Mr. WEICHEL. Do you know what that has been?

Mr. TERRY. Similar research involving control of the lampreys; biological investigation.

Mr. WEICHEL. On your foreign relations, what has been done? Have they done anything with reference to that and, if so, what?

Mr. TERRY. I don't know. I don't have any idea.

Mr. WEICHEL. That is the only part you say you know about and you don't know anything about that; is that the idea?

Mr. TERRY. At this stage of the game it is not our job and is hardly within our competence to know what the Canadians are thinking.

Mr. WEICHEL. Some of the money that is being spent is being spent on the foreign relations part of it and if you don't know what you are doing why say so.

Mr. TERRY. As I said at the beginning, we are attempting to determine what type of international instrument will best enable us to get the type of cooperation we need.

Mr. WEICHEL. What have these attempts been in the past 4 years? For the money spent what did you do?

Mr. W. F. CARBINE. None of this money has been spent on foreign-relations work. This money has been spent only for research.

Mr. WEICHEL. I want to see what this foreign relations part is, on fish and wildlife. Do you know anything about it?

Mr. TERRY. As far as this particular problem is concerned I know what we have been working on.

Mr. WEICHEL. What have you been working on?

Mr. TERRY. As I said already, we are trying to attempt to determine the specific type of instrument.

Mr. WEICHEL. This has been going on for 4 years and money has been spent for 4 years and you say you are attempting. What are the 4 years of attempts? Just what did you do in the 4 years of attempts?

Mr. TERRY. The work in our office has not been going on for 4 years. Let me put it that way.

Mr. WEICHEL. How long has it been going on?

Mr. TERRY. In the attempt to control the lamprey problem not more than a year.

Mr. WEICHEL. What was done in that time?

Mr. TERRY. We need the cooperation in order to make an effective program of control. We need the cooperation of Canada. The question is, What type of international agreement will best solve the problem in the light of the past history of the Great Lakes and other treaties on the same subject, and so on?

Mr. WEICHEL. If you don't know what they have been doing, how can you start doing that?

Mr. TERRY. We have been circumscribed in our methods of approaching the Canadians.

Mr. WEICHEL. Why?

Mr. TERRY. Just that the Department of State has ways of doing things. We are obliged to stay pretty much in those rules. We can work only very informally with the Canadians.

Mr. WEICHEL. How informal?

Mr. TERRY. Only at our level.

Mr. WEICHEL. How is that informal business coordinated?

Mr. TERRY. There are contacts, some people know each other and some correspondence. Sometimes we are able to talk things over that

way, to get some idea of what the Canadians are thinking about in this particular problem.

Mr. WEICHEL. What are they thinking about on this?

Mr. TERRY. We have only vague ideas. I, personally, have only vague ideas.

Mr. WEICHEL. After a year you have only vague ideas, after this research has been going on and we have dumped our money in this for 4 years. And you have only vague ideas.

Mr. TERRY. I say my ideas are vague.

Mr. WEICHEL. Is there anybody whose ideas are not vague?

Mr. TERRY. I think my Chief.

Mr. WEICHEL. Who is your Chief?

Mr. TERRY. The Chief of the Office of Foreign Activities.

Mr. WEICHEL. Is he here?

Mr. TERRY. He is not here.

Mr. WEICHEL. Then you don't know anything about this except reading Mr. Day's statement?

Mr. TERRY. I suppose we can safely say that.

Mr. WEICHEL. That is all.

Mr. BONNER. You say you are attempting to work out some type of instrument? What do you mean by "instrument"?

Mr. TERRY. A treaty or Executive agreement.

Mr. BONNER. Do I understand you have had no contact with the fish and wildlife agency of Canada?

Mr. TERRY. Our office has had no contact with those people.

Mr. BONNER. How would you work out an instrument if you don't consult them?

Mr. TERRY. We will eventually have to consult with them to work out an instrument.

Mr. BONNER. You say your Department has been working on this for 4 years?

Mr. TERRY. As far as I know my office has been working on the international aspect of it for 1 year.

Mr. BONNER. One year?

Mr. TERRY. No conferences.

Mr. BONNER. During that 1 year you have been attempting to find out what is necessary to reach a cooperative arrangement with them?

Mr. TERRY. There have been informal conferences with them to more or less sound out the Canadian thinking on it.

Mr. BONNER. What do you think they should do? That is what I want to get. What part of the program should they participate in as far as you are concerned?

Mr. TERRY. I am not competent to speak on the technical end of it but as far as my personal——

Mr. BONNER. I won't ask any more questions.

Mr. BOYKIN. Congressman Allen.

Mr. ALLEN. Mr. Terry, do you have a professional background and training for your position?

Mr. TERRY. No; not academically.

Mr. ALLEN. You are neither a lawyer nor a student in any field of foreign relations?

Mr. TERRY. Not academically, no. I have had some experience previously in this type of work.

Mr. ALLEN. Have you any responsibility for determining what type of instrument should be used?

Mr. TERRY. No; the responsibility is higher.

Mr. ALLEN. Have you any responsibility for recommending to your Chief what should be used?

Mr. TERRY. To a limited degree.

Mr. ALLEN. Is there any authorization in law for any type of agreement with a foreign country under the Constitution except by treaty ratified by the Senate?

Mr. TERRY. I believe they are what are known as Executive agreements.

Mr. ALLEN. Are they authorized by law or is that authority taken without authorization?

Mr. TERRY. It is authorized by law.

Mr. ALLEN. Do you know the law?

Mr. TERRY. I could not quote the law.

Mr. ALLEN. Thank you.

Mr. WEICHEL. We have been dumping our money in this thing for 4 years and just now they found out a year ago they may be there over on the Canadian side and up to this time there has not been much information from them.

Mr. TERRY. I can't say yes or no.

Mr. WEICHEL. You have already answered it. You have been there a year so the results of the 4 years is they found out they breed over on the other side and you might have to talk with them. That is wonderful.

Mr. BENNETT. Off the record.

(Discussion off the record.)

Mr. BENNETT. I don't know why Dr. Moffett couldn't read the statement.

Mr. WEICHEL. Members of our committee can read as well as this person. Instead of just coming up to read it, we can hire a reader. If we haven't got anybody on the staff who can read, I think we can hire somebody who can read.

Mr. BOYKIN. Mr. Day really intended to come. I talked to him 2 or 3 days ago and he told me he was asked to come over on the Senate side. That is the reason he is not here.

Mr. WEICHEL. That is wonderful. After spending $500,000 they come around here. That is as low a point of cooperation as you can ever get, after all this time. This sea lamprey trouble really has been there since 1940. Now he is coming around here to fish out the money and they want more and this is all the cooperation you get from them. I think it is an insult to the committee.

Mr. BOYKIN. Congressman Weichel, let us hear from Dr. James W. Moffett. He is Chief of the Great Lakes Fishery Investigations and is from Ann Arbor, Mich., and I think, without objection, we would like to hear from him.

As I told you, at any time we will get Mr. Day over here, when you want him to come.

Will you please be seated, Doctor?

Dr. MOFFETT. I regret very much that this misunderstanding arose. Mr. Day did not send Mr. Terry here to read his statement. He was asked to read it after we arrived here by me. He was not author-

ized to make any statements whatever and I think an attempt was made to shut him off.

Mr. WEICHEL. Shut him off about what?

Dr. MOFFETT. Well, he was asked to read the statement and his reason for being here, sir, is to gain background from this hearing with which he might be educated to the problem which will in the future come up. Mr. Terry is not competent to state that we are in any——

Mr. WEICHEL. Nobody said he was.

Dr. MOFFETT. What I am trying to say, sir, is we are not in any negotiations with Canada about this sea lamprey treaty but the eventuality of some sort of arrangement with Canada is very real and someone in the Office of Foreign Activities must eventually gain the experience necessary to handle that intelligently.

Mr. WEICHEL. Isn't he in that office?

Dr. MOFFETT. Yes, he is in it.

Mr. WEICHEL. Are you in that office?

Dr. MOFFETT. No, sir.

Mr. WEICHEL. He said he was in it and, therefore, he knows more about it than you do.

Dr. MOFFETT. He knows more about the Office of Foreign Activities, yes, sir.

Mr. WEICHEL. All right.

Dr. MOFFETT. But this problem has never been on the agenda of the Office of Foreign Activities.

Mr. WEICHEL. The what?

Dr. MOFFETT. The sea lampreys and international questions.

Mr. WEICHEL. What do you have to have to get it on the agenda?

Dr. MOFFETT. Sir, there is a treaty before the Senate.

Mr. WEICHEL. This is part of the deal wherein you are trying to give all the fish away in the Great Lakes to Canada for the past 25 years. This is part of the deal.

Dr. MOFFETT. No, sir; it is not part of the deal.

Mr. WEICHEL. They have been working on it since 1924. How long have you been there?

Dr. MOFFETT. I have been Chief of the Great Lakes Fishery Investigation since 1950, January.

Mr. WEICHEL. How long have you been down there at the Great Lakes?

Dr. MOFFETT. Since 1950.

Mr. WEICHEL. For 25 years they have been trying to do the thing you are talking about, to give away the whole thing over there. What do you know about it? How long have you been working with the Department?

Dr. MOFFETT. Eleven years.

Mr. WEICHEL. You know what happened then from 1924 and since the last 11 years you have been there?

Dr. MOFFETT. I know the state of the treaty which is now in the Senate Foreign Relations Committee.

Mr. WEICHEL. They have been trying to give it away since 1924, not only now. You'd better read it. Is that part of the plan?

Dr. MOFFETT. No, sir.

Mr. WEICHEL. You'd better read up on it. It is, as I get it.

Dr. MOFFETT. The sea lamprey proposal has nothing to do with it.

Mr. WEICHEL. Who was your predecessor on this thing in the Great Lakes?

Dr. MOFFETT. Dr. John Van Oosten.

Mr. WEICHEL. He has been trying to do that since 1926.

Dr. MOFFETT. You will recall that deal has changed.

Mr. WEICHEL. What changed?

Dr. MOFFETT. The whole deal on the part of the Government.

Mr. WEICHEL. What has changed? Tell me what the deal was, please?

Dr. MOFFETT. The deal was in the past and up to 1946 when the treaty was signed by the President to join with Canada in the management of the fisheries of the Great Lakes. That would have been done through a commission consisting of representatives on either side of the border, who would administer and regulate the fisheries of the Great Lakes.

Mr. WEICHEL. Now, wait a minute. That was the deal up to then.

Dr. MOFFETT. Yes.

Mr. WEICHEL. Now wait a minute. That deal, and "deal" is the right word, with 80 percent of the fish, probably, on the American side of the Great Lakes and 20 percent on their side, was to have two people from England on the commission and two people from America to control the fisheries of the Great Lakes, with the production on the American side, with no control of the fresh water fish of the big lakes of Canada. That was the deal, with them controlling their own where they produced it and the commission not controlling it, and the Americans producing 80 percent of it, and the Canadians selling theirs over here. That was the deal and it was not a good deal for America.

Now what is the deal? Is that changed?

Dr. MOFFETT. That is changed.

Mr. WEICHEL. Now what is the deal?

Dr. MOFFETT. I am inclined to agree with you in the criticism of the treaty.

Mr. WEICHEL. Now what is the deal, because I didn't know there was a change in the deal.

Dr. MOFFETT. I must speak personally because I cannot make recommendations as to what will happen to it. It is in the Department of State and we have no jurisdiction.

Mr. WEICHEL. What is the deal now? Are we going to give them, as we started to do, all the fish and provide them with the control of the fisheries on Lake Michigan?

Mr. MOFFETT. Not by Canada, sir.

Mr. WEICHEL. Yes, sir.

Dr. MOFFETT. By the United States portion of the commission.

Mr. WEICHEL. You cannot have regulations that are contrary with reference to the rest of the Great Lakes.

Dr. MOFFETT. It would be only on boundary lakes.

Mr. WEICHEL. You couldn't have anything contrary. It was a fine deal for everybody but the United States. Have we got a better deal for the United States now?

Dr. MOFFETT. The only matter we are interested in considering is some means by which this lamprey question——

Mr. WEICHEL. No; is there a better deal now for the United States?

Dr. MOFFETT. Really, there isn't any change in that treaty.

Mr. WEICHEL. What is the better deal with reference to the Fish and Wildlife? They were the ones who proposed this in 1924, Mr. Van Oosten starting it down through the years.

Dr. MOFFETT. My personal opinion is we should call that treaty back.

Mr. WEICHEL. We should call the treaty back?

Dr. MOFFETT. It is ill advised.

Mr. WEICHEL. And there is a new deal on with reference to that?

Dr. MOFFETT. There wouldn't be any deal at all. If we made any arrangement with Canada it would be for the specific purpose of controlling the sea lampreys.

Mr. WEICHEL. Are we going to get this deal back before we start giving everything away and go into another one?

Dr. MOFFETT. Yes, sir.

Mr. WEICHEL. We will get that back?

Dr. MOFFETT. I can't control the course of that treaty. I am not in that position.

Mr. WEICHEL. No one has been able to regulate the course of America's relations with reference to that question. What has been done to withdraw it?

Dr. MOFFETT. Yes; some things have been done.

Mr. WEICHEL. You mean that the Senate still, with all the business that they have, still wants to keep it and it has not been sent back. Has it been withdrawn?

Dr. MOFFETT. The State Department has to withdraw it. We of the Fish and Wildlife Service cannot do that.

Mr. WEICHEL. That is right. You can't do it.

Dr. MOFFETT. The State Department has under consideration the possibility of withdrawing the treaty.

Mr. WEICHEL. How long has the State Department have to have something under consideration, the possibility of withdrawing something that will give away the natural resources of the United States and give it to a foreign government? How long do they have to have it under consideration before they act? It seems that Secretary Acheson is giving away everything else, including Asia. How long has it been before the State Department?

Dr. MOFFETT. Since 1946.

Mr. WEICHEL. How long has this withdrawal been under consideration, that we shouldn't give everything away?

Dr. MOFFETT. For this last year.

Mr. WEICHEL. It has been under consideration this past year?

Dr. MOFFETT. Yes. We must move slowly in this matter.

Mr. WEICHEL. Oh, yes, they are slow in stopping giving it away but awfully fast in giving it away.

Mr. BONNER. Mr. Chairman, would Mr. Weichel yield?

Mr. WEICHEL. I would like to finish.

Do you know the name of the person in charge of this in the State Department?

Dr. MOFFETT. No.

Mr. WEICHEL. Are there any people here who would know what division of the State Department?

Dr. MOFFETT. It probably rests within the authority—and this is a personal opinion——

Mr. WEICHEL. I thought maybe somebody could tell me.

Dr. MOFFETT. I can't say but it probably rests within the authority of the Foreign Adviser of the State Department. He would make the final decision.

Mr. WEICHEL. Has there been any decision made or do you know?

Dr. MOFFETT. I don't know, really. I don't know whether there has been a recommendation or not but that is the trend of the thinking.

Mr. WEICHEL. Is Mr. Van Oosten still down there, the guiding person who received his payroll of up to $10,000 a year and who sat on his seat up in Ann Arbor for 26 years?

Dr. MOFFETT. He is still there. Dr. Van Oosten is still there.

Mr. WEICHEL. He is still there in that position?

Dr. MOFFETT. No, sir; I took his position.

Mr. WEICHEL. Are you carrying on as he has with reference to further promoting it?

Dr. MOFFETT. No, sir.

Mr. WEICHEL. Is he still with the Department?

Dr. MOFFETT. Yes, sir.

Mr. WEICHEL. What is he doing now?

Dr. MOFFETT. He is completing the work he had on file prior to retirement.

Mr. WEICHEL. What kind of work?

Dr. MOFFETT. He had tremendous files on research work he had done through his career.

Mr. WEICHEL. I know he had tremendous files for 26 years trying to give things away to Canada, but what else has he done?

Dr. MOFFETT. He is a very competent scientist, sir.

Mr. WEICHEL. On what?

Dr. MOFFETT. On fisheries on the Great Lakes.

Mr. WEICHEL. The testimony was he tried to give these things away starting in 1924. Has he done anything technically besides this foreign relations business? I thought that was the State Department's job.

Dr. MOFFETT. I am not competent to say.

Mr. WEICHEL. What is his technical work?

Dr. MOFFETT. He has done a great deal of work on growth rate, population and distribution of the species and other biological work in the Great Lakes. He has worked on size of mesh nets needed in conservation of wildlife.

Mr. WEICHEL. Is that what they had in connection with this flexible rule business?

Dr. MOFFETT. Yes, sir. Dr. Van Oosten has made a great contribution to the knowledge of the Great Lakes' fisheries. It is unfortunate that he got himself involved in this matter which you are talking about.

Mr. WEICHEL. Yes; he started back in 1924, at the time that the herring started to disappear from the deep places off of Erie, Pa., and they asked to study why, and he embarked on a thing 26 years ago showing how you can give the whole thing away to Canada.

Dr. MOFFETT. The thing can be studied as a biological unit, not a human unit.

Mr. WEICHEL. He was not asked to spend the Government's money and the time and effort of those people in it on working this thing up over a period of 26 years. Now, that is another example of bureaucrats in bureaus doing something that they were never authorized to

do or spend the money on, and I am glad that he is retired. If he isn't I will help him out of it.

So there is going to be a new deal on? When the new deal is on this, this other new deal of giving it away was part of the new deal, but you are not referring to that type of new deal, are you? It is not with reference to those kind of deals?

Dr. MOFFETT. No, sir. We are interested solely in protecting and conserving the valuable fisheries in the three upper lakes.

Mr. WEICHEL. For the United States?

Dr. MOFFETT. For the United States; yes, sir.

Mr. WEICHEL. That is wonderful.

Dr. MOFFETT. Our fishermen are starving to death.

Mr. WEICHEL. That is the first time anybody was interested in protecting anything for the citizens of the United States, whether they were fish, migratory birds, or anything else. That is wonderful and I hope the boss and everybody goes for that same thing.

Dr. MOFFETT. I think that the other testimony that is not concerned with governmental matters will bring that out.

Mr. WEICHEL. I am interested in governmental matters because I know what is happening on this other one. Evidently because we did pay little or no attention we found that for 25 years——

Mr. BENNETT. I missed the end of your statement.

Dr. MOFFETT. I just said that I was almost sure that subsequent testimony of the people not in the Government would bring out the fact that the fishery is in a bad state.

Mr. WEICHEL. Everybody knows that since 1924.

Dr. MOFFETT. Yes, sir.

Mr. WEICHEL. There has been plenty of testimony in this committee, some of it recorded and some not recorded. Anybody connected with the Fish and Wildlife Service should know it since 1926.

Dr. MOFFETT. We do know it.

Mr. WEICHEL. People on the outside have known it for a long, long time. I was hoping the people inside would know about it.

Dr. MOFFETT. We are very well aware of it.

Mr. WEICHEL. I hope somebody recognizes it. I hope it is the policy of the boss of the department. He has had some kind of change of heart, instead of carrying on this kind of thing. It is a happy thought to know that somebody like you has some interest with reference to the resources of the people of the United States in not giving them away.

Mr. BENNETT. You were about to make a statement. It was your personal conviction of something.

Dr. MOFFETT. It is my personal conviction, gentlemen, and this is not science, that our major obligation in this whole matter is to give unto about 5,000 people who are on the direct producing end of this thing a chance to make a good, straight, honest living, and it seems to me those people are the kind of people we would like to have in the United States. That is my opinion.

Mr. WEICHEL. Then this philosophy that has been going on for 26 years, including down through Mr. Day, and all the efforts he could put forth, with pressures and the use of the money and everything else, that with reference to the fisheries on the Great Lakes and with reference to the resources that the fact that some other country produces all that they produce, which is sold in the United States and

that people engaged in the fishing business on the Great Lakes can't go into some other kind of business, and we should take it from there that that point of view is now changed.

Dr. MOFFETT. Yes, sir.

Mr. WEICHEL. In other words, it has been absolutely expressed that with reference to an adjoining free country, that with reference to what they produce, 90 percent of it is sold in the United States, and that with reference to those engaged in a similar fishing business in the United States, they can go out and push plows just as well. So I am glad that that attitude has change.

Mr. BOYKIN. Are there any other questions, gentlemen?

Mr. BONNER. You do not come before the committee speaking with any authority as to the policy of the Fish and Wildlife Service with respect to any treaties?

Dr. MOFFETT. No, sir.

Mr. BONNER. And those matters?

Dr. MOFFETT. No, sir.

Mr. BONNER. You just come to talk about this eel business?

Dr. MOFFETT. The sea lamprey; that is right.

Mr. WEICHEL. This is tied into this thing.

Mr. BONNER. I am going to get to that if you let me finish. I think you have had an interesting discussion here but I do think that the chairman of the committee said he would bring down the Administrator to air out the subject you are discussing.

Mr. WEICHEL. This is part of the same thing and the same international business, and this is the place to develop it.

Mr. BONNER. Is this part of the lamprey eel control business?

Mr. WEICHEL. Certainly. They started out before on the control of fishing as to why the herring were disappearing up there and they had begun with that, so the same thing with the lamprey. They will give everything away.

Mr. BONNER. They will give them the eels?

Mr. WEICHEL. No, they will give them everything that is good. Anything that is no good, we keep. That has been the policy.

Mr. BENNETT. I would like to ask the witness if he has testified to what he came here to testify on. This is all very valuable but you are no authority on it, I believe.

Dr. MOFFETT. No, sir.

Mr. BENNETT. Will you tell us what you are here to testify on?

Dr. MOFFETT. I would like to get on with this program. It is rather long.

Mr. WEICHEL. You say you are here in connection with this program that has been going on for 24 years?

Dr. MOFFETT. The control of the lamprey was not a problem at that time.

Mr. WEICHEL. Do you know when the treaty was drafted?

Dr. MOFFETT. In 1944.

Mr. WEICHEL. Well, a little later, in 1946. It has been a problem since 1940, if you read your own records.

Dr. MOFFETT. It has not been one of high economic importance which would jettison it before you, sir.

Mr. WEICHEL. They have hardly been able to catch anything commercially since 1940. I want to mention it because if we are going

to start out on erroneous information that this was not a problem until 1946, I want to have him examine the records down there.

Mr. BENNETT. I think we are cross-examining the man before he expressed his own opinion.

Mr. WEICHEL. I wish someone would tell me why it did not become a problem until 1946 after sitting here for 10 years.

Mr. BENNETT. From my standpoint, if you could allow him to testify on what he came here to testify and then, if you would cross-examine him after that, I think it would add to the information on the subject because we have had a great deal of information brought here about the incompetence of our Government but I am interested in doing some necessary work on the question of fisheries.

Mr. WEICHEL. I have been sitting here listening to this same kind of bunk for 10 years.

Mr. BENNETT. I would like to listen to the testimony he came down here to say and then listen to the others, too. If the chairman would permit him to testify, then we can cross-examine.

Mr. WEICHEL. This is the first ray of light that I have seen from anybody in 10 years down here. This is the only opinion this committee ever had.

Mr. BENNETT. Mr. Chairman, would it be all right if he testifies what he desires to testify to and then we can cross-examine him at the end?

Mr. BOYKIN. And get the other fellows who know about it.

Mr. WEICHEL. I want to get the things that are right while he is here.

Mr. BENNETT. I have no idea what he knows about the lamprey eel. I am concerned with waste in Government and in the State Department, but that is not the business of this committee.

Mr. WEICHEL. I have been studying this for 10 years and then somebody tells me something else about it.

Mr. BENNETT. May I ask you a question? Is that permissible?

Mr. BOYKIN. Yes.

Mr. BENNETT. Then I would like the witness, if it is permissible, without interruption, to answer this question: What did you come down here to testify about and please make your statement?

Dr. MOFFETT. The plan was to have Mr. Day present the lamprey situation in the three Lakes and then, as a means of review, I was to present a movie showing the work we have been doing and the life history of the lamprey. It will save a lot of words, and then to outline the accomplishments which we have made to date with the money you gave us last year and then present the future program, and we may have to cut that short. Would you prefer to do without the movie?

Mr. BOYKIN. I would like to see it, myself. We have given them half a million dollars here.

Mr. BOYKIN. Do you want Dr. Hile to speak first?

Dr. MOFFETT. Yes.

Mr. BONNER. I want Mr. Weichel to know that I was not attempting to cut off his questioning.

Mr. BENNETT. I want him to understand that, too, but I wanted him to come to the thing which we are interested in.

Mr. WEICHEL. I sit here personally and listen to this and the Director of the Fish and Wildlife Service has not been here for I don't know how many years and he sends somebody down here to read a paper and

then you have foreign relations with reference to this, and my experience with foreign relations as far as resources and fisheries of the Great Lakes with reference to this Department are concerned is that they have been absolutely no good, and I want to bring it in here with reference to Mr. Van Oosten, and if it is going to be different and they are not going to give anything away, that is what I want to know before you go any further in this.

STATEMENT OF DR. RALPH HILE, ASSISTANT CHIEF, GREAT LAKES FISHERY INVESTIGATIONS, FISH AND WILDLIFE SERVICE, ANN ARBOR, MICH.

Dr. HILE. My name is Ralph Hile. I am Assistant Chief of the Great Lakes Fishery Investigations, Fish and Wildlife Service, Ann Arbor, Mich.

Before Dr. Moffett gives us his figure on research, I should like to bring you up to date on the economic situation with particular reference to the losses to the commercial fishing industries from the sea lamprey.

We mentioned last year that the lake trout, the No. 1 species in the Great Lakes with reference to monetary returns to the fisheries, has been the principal victim of the sea lamprey.

Each one of you has been given some tables with reference to the situation, so I won't go into it. You can look at it at leisure.

The first of the tables makes a comparison of the 1950 production of lake trout for individual areas of the three upper Lakes with the earlier catch over a period of years prior to the spread of the sea lampreys. I will summarize that part very briefly.

In the United States waters section of Lake Huron the former annual catch ran around 1,685,000 pounds. As has been stated earlier the 1950 catch was nothing—less than 100 pounds. We have a loss to the fisheries of $842,000.

On the Ontario side of the lake the situation was identical. The normal catch was in the neighborhood of 1,600,000 pounds. In 1950 the catch was 6,000 pounds. The annual loss is $794,000.

In Georgian Bay, a somewhat more productive area, it was yielding somewhere in the neighborhood of 2,000,000 pounds annually—just slightly under there—and they still have some slight production in 1950 of 405,000 pounds, but that was an 80 percent loss.

The grand total for Lake Huron both the Canadian and the United States fisheries, shows that both Canada and the United States are being deprived of almost 5,000,000 pounds of lake trout worth $2,432,000.

Lake Michigan was invaded by the lamprey somewhat later but the collapse there has been just as complete. Over a term of about 17 years preceding the decline brought about by the lamprey, the average catch in the four States of Michigan, Wisconsin, Illinois, and Indiana—and most of that catch was in Wisconsin—ran somewhat over 5½ million pounds; 5,650,000, to be exact. The 1950 catch was 54,000 pounds, and as mentioned in Mr. Day's statement, the preliminary statistics would show there was almost nothing at all in 1951. And we have a loss to the fishermen each year of the total catch of about 5½ million pounds worth about $2,798,000.

To date we have no evidence that the sea lamprey has done any serious injury in Lake Superior. Although it is in the lake and has been caught in all portions, there has been no decline. We can attribute no decline to the sea lamprey. In Lake Superior the catch in 1949 and 1950 was the same and has been just a little bit over 3,000,000 pounds in Michigan, Wisconsin, and Minnesota, and has been in the neighborhood of 1,400,000 pounds in Ontario. Together, as in all of Lake Superior, the take has amounted to about 4,444,000 pounds. The current market value would be worth around $2,222,000. That fishery still remains to be saved.

At the bottom of the table you will see the aggregate.

Under the former more or less normal conditions the annual production of lake trout in all United States waters was around 10 million pounds. In the Canadian waters or Ontario waters it was around 5 million pounds. Together it was around 15,000,000 pounds. At present market prices that catch would be worth $7½ million.

Actually, the production in 1950 was worth $2,500,000, so we have suffered and are suffering annually a loss of around $5 million per year.

Now, the second table and, incidentally, the chart we have here I think you all have copies of—this chart covers a point on which some of you expressed interest last year and that is the distribution of Great Lakes fisheries and the sea lamprey. Among several States and Provinces in the pie diagram at the left you have the distribution of the normal catch of lake trout and you will find that material detailed in the second of the two tables.

Of the States and Provinces bordering on the Great Lakes, Michigan has always been the heavy producer of lake trout. In a normal production year their production has been in the neighborhood of 6,000,000 pounds, Ontario 5,000,000 pounds, Wisconsin runs third with an annual take of 3,000,000 pounds. The three States of Illinois, Minnesota, and Indiana had relatively unimportant takes and among them produce only about 6½ percent of the total.

Here on the right we have the distribution of the 10 million pounds and the approximately $5 million being lost annually and that distribution bears considerable resemblance to the normal catch. The big loser has been Michigan, which today is losing a little over 4 million pounds a year at the dollar rate of somewhat over $2 million.

Ontario is losing somewhat over 3,000,000 pounds or a little better than $1½ million. Wisconsin is losing at the rate of about 2½ million pounds and $1,258,000 and Illinois and Indiana have been wiped out. They suffered a 99 to 100 percent loss. We cannot demonstrate any loss for Minnesota but the major units have suffered losses approximately in proportion to their original stake in the fisheries.

Those figures relate only to the lake trout fishery and the normal aspects of it. We can't estimate the loss of the sport fishery, which was rather popular in the Grand Traverse Bay of Lake Michigan, and we must think in terms of the really extensive sport fishery of the southern shore of Lake Superior. Neither have we made any estimate of the other fish, such as the whitefish, yellow perch, walleye, suckers, and other fish.

It is hard to sort out what might be the loss due to the lamprey and what might be the loss due to other causes. Those other fish too are suffering rather severe injuries.

That is all I have.

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Mr. BOYKIN. Gentlemen, are there any questions?

Mr. WEICHEL. Mr. Chairman.

Mr. BOYKIN. Yes, Mr. Weichel.

Mr. WEICHEL. What is a so-called normal year? How did you arrive at that? What does that mean?

Dr. HILE. They are all listed at the bottom of the table. They are the most recent periods in which there wasn't any change of general level.

Mr. WEICHEL. Normal, what is that, from 1930 to 1940 or from 1920?

Dr. HILE. They varied in each area. We examined statistics and took the most recent period over which the production was steady and said that is what we can expect under normal conditions.

Mr. WEICHEL. When was Lake Ontario a great producer of lake trout?

Dr. HILE. It never was.

Mr. WEICHEL. So those figures don't mean anything when you add that into the loss because it never was a producer.

Dr. HILE. Lake Ontario does not enter into the loss. This is based on the three upper lakes. Ontario has always had sea lampreys. It never has produced any great quantities of trout.

Mr. WEICHEL. You used Ontario.

Dr. HILE. No. I was speaking of the Province, sir. I am sorry if you misunderstood.

Mr. WEICHEL. You mean the Province of Ontario?

Dr. HILE. Yes. They own the complete Canadian shore line.

Mr. WEICHEL. The Province of Ontario, Canada, covers all the Great Lakes? That is Ontario all the way across?

Dr. HILE. Yes. I gave the losses by Provinces and the individual lakes—Huron, Michigan, and Superior.

Mr. WEICHEL. What years are you calling normal in Lake Huron?

Dr. HILE. Here we are. Canadian waters of Lake Huron; I took 1923 to 1939. There is a hiatus in the statistics prior to 1923 in which I could not break the lake down to its component parts. The level of yield was rather steady. If you are interested in details I can make this up for you.

Mr. WEICHEL. No. What years do you take the State of Michigan with reference to Lake Huron, as normal?

Dr. HILE. That is from 1895 to 1939. In other words, they have had a fairly stable fishery to 1939.

Mr. WEICHEL. Up to 1939?

Dr. HILE. Yes, then we got some signs of severe injury. I think every year after 1939 gave us a new low. I am not sure.

Mr. WEICHEL. What were they doing in that State?

Dr. HILE. I don't think they were doing anything at that time. I am not competent to speak on their program.

Mr. WEICHEL. What years did you take with reference to Lake Michigan?

Dr. HILE. In Lake Michigan we were taking for our so-called normal period 1927 to 1944. That actually puts two periods together. Immediately prior to the collapse Lake Michigan was having somewhat better than normal production. We were getting about 6½ million pounds a year. We were not sure that might not be temporary so we extended our figures back to 1918.

Mr. WEICHEL. How do you account for this extreme production and then it disappeared? Is that from the sea lamprey?

Dr. HILE. The best evidence permits no other conclusion. We know, for example, it was not fishing intensity. We have very good records. The fishermen have been blamed for the loss of the lake trout but the evidence won't permit that interpretation where we have records.

Mr. WEICHEL. With reference to Lake Superior you are producing more than normal up there.

Dr. HILE. 1950 in Lake Superior was a very good year and we will give you a paper carrying some details. In 1950 they were somewhat above average.

Mr. WEICHEL. What is the normal catch on Wisconsin?

Dr. HILE. I believe it was 533,000 and they are now at 591,000. They are above normal.

Mr. WEICHEL. What is the period that they were supposed to be normal?

Dr. HILE. Lake Superior; that is 1926 to 1949, sir.

Mr. WEICHEL. And with reference to the Canadians on Lake Superior?

Dr. HILE. That we took as 1930 to 1949. There came a slight break in statistics.

Mr. WEICHEL. There is an increase there.

Dr. HILE. Yes; they were producing somewhat above average. I think a great deal of that—I know it is true in Michigan—has come from increased fishing pressure. They have a monopoly on the market.

Mr. WEICHEL. Who has a monopoly?

Dr. HILE. The Lake Superior fishermen have a monopoly on the lake trout. They don't compete with the lower lakes.

Mr. WEICHEL. They are fishing more?

Dr. HILE. Yes. They go in for heavier fishing because we have a record of the quantity of gear lifted.

Mr. WEICHEL. The Canadians in Lake Superior fish all year around. There is no closed season on the Canadian side at all.

Dr. HILE. I think you are right.

Mr. WEICHEL. So we protect them on our side and have a closed season so they can take them all year around and have more over there.

Dr. HILE. That is a source of distress to our fishermen.

Mr. WEICHEL. That is the kind of cooperation we have.

Mr. BONNER. I understood you to say the Canadian side is where they fish all the year around?

Dr. HILE. They have no closed seasons.

Mr. BONNER. But I mean do they bring those fish over in the commercial markets in the United States?

Dr. HILE. Yes, sir.

Mr. WEICHEL. Ninety percent of it is sold in American markets, in New York and Chicago.

Dr. HILE. Yes, about that.

Mr. BONNER. Has that been the custom over on the Canadian side in all the lakes, that they can fish through the year?

Dr. HILE. I don't know of my own knowledge but I do not think the Canadians have had any closed season for spawning.

Mr. WEICHEL. The statistics some years back show 90 percent of all the fresh water fish taken in Canada are sold in the United States.

Mr. BONNER. And there is a prohibition here with respect to the take but no prohibition with respect to the sale?

Dr. HILE. The Canadian fishermen catch them at all times. They catch them when the American fishermen are tied up.

Mr. WEICHEL. They have no prohibition on taking or selling but the Americans have a prohibition on taking them and a prohibition on selling, so we provide a market for the Canadians without any prohibitions. Is that true of their lakes up there?

Dr. HILE. I don't know about their lakes.

Mr. WEICHEL. Lake Winnepeg and Lake Saskatchewan are not too small.

Dr. HILE. They have a winter season and a late season and they are rather controlled.

Mr. WEICHEL. If we are going to have a treaty to promote the control of all the fresh water fisheries of the Great Lakes and 90 percent of them taken by the Canadians are sold in the American markets but did not have any control of the large lakes inside of Canada, Lake Saskatchewan and Lake Winnepeg, and had no control over their fishing t all——

Dr. HILE. That is correct.

Mr. WEICHEL. And they exercise no control or prohibition whatever with respect to the taking of fish in the Great Lakes and sell them over here——

Dr. HILE. That is correct.

Mr. WEICHEL. So our cooperation is wonderful. We are going to take the sea lampreys out for them and enable them to take more fish and sell them over here.

Mr. BONNER. With respect to the breeding ground, something said in Mr. Day's statement; what is your division with respect to the breeding ground between the Canadian border and the United States border?

Dr. HILE. The breeding ground for what?

Mr. BONNER. Well, we are talking about fish. We are not talking about women or men.

Dr. HILE. You mean on all fish?

Mr. BONNER. I am talking about the spawning grounds.

Dr. HILE. Yes, there are spawning grounds for species in all lakes. The lake trout, for example, moves in on reefs, certain types of bottom around the periphery of the lake.

Mr. BONNER. The breeding ground on the Canadian side is fully as prolific as on the United States side?

Dr. HILE. That is correct.

Mr. BONNER. You are putting the decline of fishing on these lakes entirely on this eel proposition?

Dr. HILE. We think that is the major cause.

Mr. BONNER. Don't you have to have some protection of breeding grounds to perpetuate or stabilize the production of sea food?

Dr. HILE. That is a very difficult question. I think the importance of protecting spawning fish has been greatly exaggerated.

Mr. BONNER. You mean you don't have to have any new ones then? You just keep catching up the old ones?

Dr. HILE. Every fish has to have parents but the misconception that has been generally propagated is that the number of young that are produced will be in direct proportion to the number of adults that spawn. That does not hold up. Some of our most productive reproduction of young comes where the adults are sparse and some of our poorest reproduction comes where it is teeming with fish.

Mr. BONNER. I understand they eat each other up but nature has got to have some balance.

Dr. HILE. I might say that Lake Michigan is protected by a closed season. That is entirely United States waters and that area has collapsed.

Mr. BONNER. Are the breeding areas in Lake Michigan as favorable as the breeding conditions in other lakes?

Dr. HILE. There is no reason why they are not.

Mr. BONNER. You don't think there is any migration of these fish?

Dr. HILE. We do know they are moved but there is no tremendous——

Mr. BONNER. You are studying it?

Dr. HILE. We are studying it.

Mr. BONNER. You are studying it now?

Dr. HILE. Yes, sir.

Mr. BONNER. But when this first arose you gave no study to that?

Dr. HILE. In the past years we had no funds. There was a long period when we had only $1,500 to cover all field operations.

Mr. BONNER. Is the Canadian Government interested in that?

Dr. HILE. The Canadian Government does no research on the Lakes. They are interested in the fishery but not doing research on the Great Lakes.

Mr. BONNER. Has there been any collaboration between the Canadian Government and your agency with respect to the propagation and protection of fish?

Dr. HILE. Naturally, no binding agreement has been reached.

Mr. BONNER. I am not asking you about any binding agreement.

Dr. HILE. There has been some cooperation on research. There is nothing that has come to a head.

Mr. BONNER. Do you think it is fair to prohibit the American's taking fish and permit the foreign taking and foreign selling in competitive waters?

Dr. HILE. No, sir, I don't.

Mr. BONNER. Well, then, I am trying to get myself to go along with this problem. How are you going to work out some satisfactory solution of it unless there is a unanimous effort or agreeable effort on both parts? What is the difference in the shore line on a percentage basis?

Dr. HILE. Oh, I would——

Mr. BONNER. Just estimate.

Dr. HILE. Just about as in area and fish production. About two to one.

Mr. BONNER. We have two to their one?

Dr. HILE. About that, roughly speaking. Lake Michigan gives us a big edge.

Mr. WEICHEL. We are not interested in Lake Michigan. That is all domestic.

Mr. BONNER. What is the difference on a percentage basis of the activity of fishing?

Dr. HILE. We do not have accurate statistics on the Canadians' fisheries. We have their estimated production. I suppose their fishing is as good as ours, and in some places better, but we do not have the exact figures to give you an appraisal.

Mr. BONNER. You know what I am trying to work out in my own mind?

Dr. HILE. Yes, I know what you are getting at.

Mr. BONNER. We are not having this difficulty in the Great Lakes only. We are having the difficulty of the disappearance of fish in abundance and that is what has happened here. I want to find out how thoroughly you go after the problem before you present it and lay the charge that some certain thing is the cause of it.

Dr. HILE. We have studied all the evidence carefully on the lamprey. We went into certain statistics and followed the changes in the fish in the lake.

Mr. BONNER. Predatory fish are everywhere. It is the evolution of the fish life but to make the specific charge that this one animal that has been there always——

Dr. HILE. No, not the lamprey. It is a new animal in the Lakes. It is not native to the Lakes. It escaped up into the upper Lakes obviously through the Welland Canal and the first one was caught in the lake early in the twenties. It was not found in Lake Huron until the late thirties. It is a new animal and it was coincident with its spread that badly injured lake trout appeared in abundance and the catch began to go down. It is a new animal in the Lakes.

Mr. BONNER. Would we ever get a solution of this problem unless we had a cooperative effort between the two that are interested in it?

Dr. HILE. I think not.

Mr. BONNER. Then what is the argument about here?

Dr. HILE. Pardon?

Mr. BONNER. Unless we can get a cooperative arrangement with Canada on this effort then you are just merely wasting time, aren't you?

Dr. HILE. It would be for us to institute control; you are right.

Mr. BONNER. I am very sympathetic towards this whole thing. Now, you gentlemen are the ones who studied this. It is your business but as a practical angle—I look at it from that angle—I ask you that question. What is the use of going on with this effort until we finally get down to the place where we are both interested and we both work out a general agreement?

Dr. HILE. I think Dr. Moffett brought out it has been our effort to develop the methods for controlling the parasite and directly we have the methods worked out we should have arrangements for cooperative efforts.

(The tables and chart referred to in Dr. Hile's testimony follows:)

Comparison (by lake and State or Province) of the pounds and value of lake trout production in Lakes Huron, Michigan, and Superior for 1950 with the modern normal for those waters, and an estimate of losses resulting from sea lamprey depredations in Lakes Huron and Michigan

[Values computed at rate of 50 cents per pound]

Region	Normal catch [1]		1950 catch		Loss		Percentage loss
	Pounds	Value	Pounds	Value	Pounds	Value	
	In thous.	*In thous.*	*In thous.*	*In thous.*	*In thous.*	*In thous.*	
Lake Huron: Michigan	1,685	$842	.....	.....	1,685	$842	100
Ontario:							
Huron proper	1,600	800	11	$6	1,589	794	99
Georgian Bay	1,996	998	405	202	1,591	796	80
Ontario total	3,596	1,798	416	208	3,180	1,590	88
Grand total	5,281	2,640	416	208	4,865	2,432	92
Lake Michigan:							
Michigan	2,525	1,263	25	12	2,500	1,250	99
Wisconsin	2,542	1,271	25	12	2,517	1,258	99
Illinois	457	228	4	2	453	227	99
Indiana	126	63	.....	.....	126	63	100
Grand total	5,650	2,825	54	27	5,596	2,798	99
Lake Superior:							
Michigan	2,180	1,090	2,400	1,200	[2]	[2]	.....
Wisconsin	533	267	591	296	.....	.....	.....
Minnesota	336	168	202	101	.....	.....	.....
United States total	3,049	1,525	3,193	1,597	.....	.....	.....
Ontario	1,395	698	1,506	753	.....	.....	.....
Grand total	4,444	2,222	4,699	2,350	.....	.....	.....
All United States waters	10,384	5,192	3,247	1,624	7,281	3,640	70
All Ontario waters	4,991	2,496	1,922	961	3,180	1,590	64
United States and Ontario	15,375	7,688	5,169	2,585	10,461	5,230	68

[1] Periods of years on which the modern "normal" catches are based: Canadian waters of Lake Huron, 1923–39; United States waters of Lake Huron, 1895–1939; Lake Michigan, 1927–44; Canadian waters of Lake Superior, 1930–49; United States waters of Lake Superior, 1926–49.

[2] In this tabulation differences between the 1950 and the normal catches in Lake Superior are not interpreted as gains or losses; the total losses at the bottom of this column, therefore, are the sums of the losses in Lakes Huron and Michigan.

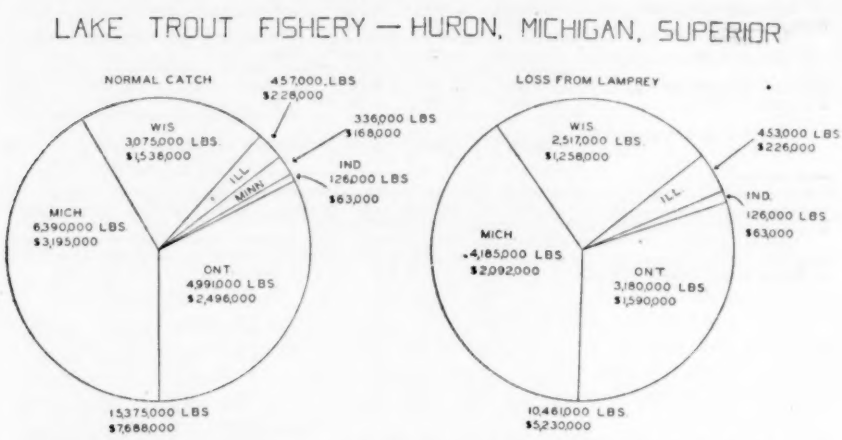
Comparison (by State or Province) of the pounds and value of the lake trout production in Lakes Huron, Michigan, and Superior for 1950 with the modern normal for those waters and an estimate of losses resulting from sea lamprey depredations in Lakes Huron and Michigan

[Values computed at rate of 50 cents per pound]

Region	Normal catch [1]			1950 catch			Loss [2]			Percentage loss in region [2]
	Pounds	Value	Percentage of total	Pounds	Value	Percentage of total	Pounds	Value	Percentage of total	
	In thous.	*In thous.*		*In thous.*	*In thous.*		*In thous.*	*In thous.*		
Michigan	6,390	$3,195	42	2,425	$1,213	47	4,185	$2,092	40	65
Wisconsin	3,075	1,538	20	616	308	12	2,517	1,258	24	82
Illinois	457	228	3	4	2	0	453	227	4	99
Minnesota	336	168	2	202	101	4			0	
Indiana	126	63	1			0	126	63	1	100
United States total	10,384	5,192	68	3,247	1,624	63	7,281	3,640	70	70
Ontario	4,991	2,496	32	1,922	961	37	3,180	1,590	30	64
Grand total	15,375	7,688	100	5,169	2,585	100	10,461	5,230	100	68

[1] Periods of years on which the modern "normal" catches are based: Canadian waters of Lake Huron, 1923–39; United States waters of Lake Huron, 1895–39; Lake Michigan, 1927–44; Canadian waters of Lake Superior, 1930–49; United States waters of Lake Superior, 1926–49.

[2] Based entirely on losses of production in Lakes Huron and Michigan; differences between the 1950 and the normal catches in Lake Superior are not interpreted as gains or losses.



Mr. BONNER. Gentlemen, I think you have the horse before you have the vehicle to ride in. I think you should get the vehicle first and then both parties try to ride in on it. What do you think of that, Doctor?

Dr. MOFFETT. I think your reasoning is perfectly sound and I really agree with you. I am sure we want to demonstrate that we have about reached the end of the research phase of this thing, that we are now almost ready to go into application. As we go into application there will be need for some international arrangement.

Mr. BONNER. Doctor, it is evident that you simply have got to have it.

Dr. MOFFETT. You have got to have it, otherwise there is no reason for the United States spending its money.

Mr. BONNER. That is why I asked if you collaborated with the similar interests in Canada to get a mutual agreement with them.

Dr. MOFFETT. We have with the Department of Lands and Forests in the Province of Ontario, which represents the fisheries. That has to be small.

Mr. BONNER. Is the Canadian Government interested in protecting their shores like we are?

Dr. MOFFETT. Yes.

Mr. BONNER. Are they cooperating? The chairman wants to know if they are cooperating with you in that study.

Dr. MOFFETT. Yes, very definitely. They are spending upward of $35,000 to $50,000 a year. That is the Province of Ontario that spent that money.

Mr. BONNER. Are they cooperating with this electrical program you are initiating?

Dr. MOFFETT. They are going to put one of the screens on their side and operate it when the sea lampreys migrate next spring. They are interested in getting some sort of international arrangement to exercise this control as a functional unit but both country's participation has been very good. There will be no hitch that I can see but perhaps I don't comprehend the total picture but as far as the people with whom we work, they are very much interested in and willing to enter into any sort of reasonable effort whereby the effort can be a mutual effort in the eradication of the pest. This matter is aside from the current treaty that has been up for discussion.

Mr. BONNER. What is the general food of the lake trout in the Great Lakes?

Dr. MOFFETT. The lake trout is mainly a fish-eater. He lives mainly on lake herring, chubs, cottids or Miller's thumbs, and sticklebacks.

Mr. BONNER. Has the quantity of that food increased?

Dr. MOFFETT. Yes, it has in Lake Michigan. The quantity has increased several million pounds.

Mr. BONNER. Is the food all food fish?

Dr. MOFFETT. Yes, but not too good a food fish. It has to be smoked. It can't be eaten fresh.

Mr. BONNER. Is it being used for oil production?

Dr. MOFFETT. No, most of the fresh water fishes are not very good for oil production. They don't have quite as much oil as the sea fish.

Mr. BONNER. Are they used for fertilizer?

Dr. MOFFETT. No. Most of the fishes are channeled into human consumption uses.

Mr. BONNER. The reason I ask you is there has been a noticeable reduction of trout on the Atlantic Coast due to the necessity of shrimp fishing. Whether it is due to that, I don't know, but it has happened since shrimp fishing became so prominent and since it began to be a principal industry.

Dr. MOFFETT. Yes.

Mr. BONNER. I was wondering whether your agency had considered lack of food.

Dr. MOFFETT. You mean the lake trout, don't you?

Mr. BONNER. Your lake fish; the subject here.

Dr. MOFFETT. Are you speaking of the Gulf?

Mr. BONNER. I am coming back to the lake fish, and am asking whether the food condition has anything to do with the diminishing.

Dr. MOFFETT. No. As far as we can tell the food has been relatively stable and, in fact, in abundant supply. There has been little or no change in that.

Mr. WEICHEL. With reference to the food, you mentioned one of the principal foods of the lake trout is the herring.

Dr. MOFFETT. Yes.

Mr. WEICHEL. It is true that the herring disappeared from Lake Erie and there hasn't been any since 1924. There were lake trout in the eastern area, in the deep waters. Is there herring in Lake Huron or has the smelt moved in? The herring is the food for the smelt, is that true?

Dr. MOFFETT. There are very abundant stocks of herring in Lake Superior, Lake Huron, and Lake Michigan.

Mr. WEICHEL. There are?

Dr. MOFFETT. Yes, sir.

Mr. WEICHEL. I have heard it said by commercial fishermen in Lake Superior on the Canadian side that the smelt has started to come into Lake Superior and that the smelt is not a food for the lake trout and that the smelt were making some inroads on herring. I was wondering about the condition that brought in.

Dr. MOFFETT. We are not in a position to say how abundant the smelt are at the present time.

Mr. WEICHEL. They are abundant in Lake Michigan, aren't they?

Dr. MOFFETT. They are coming back to their former abundance but in 1943 they were stricken almost to the vanishing point by a disease.

Mr. WEICHEL. The smelt?

Dr. MOFFETT. Yes.

Mr. WEICHEL. What relation did the smelt have with reference to the herring, which is a natural food of the lake trout?

Dr. MOFFETT. The stocks were relatively low and have come back up since, but we are not sufficiently advised to know whether the relationship between the two species may be binding.

Mr. WEICHEL. The production of the herring has been sort of related to the lake trout. Hasn't it been that way in Lake Michigan? It takes some time after the restoration of the herring for the lake trout. It will take some time to restore the lake trout. How big does a lake trout grow in 1 year from spawning?

Dr. MOFFETT. Oh, about 4 inches.

Mr. WEICHEL. So it would take quite a few years to get a stock of lake trout?

Dr. MOFFETT. It would take them from 6 to 7 years to enter the commercial fishery of 2 pounds.

Mr. WEICHEL. How big will they be?

Dr. MOFFETT. About 17 inches or about 2 pounds in weight.

Mr. WEICHEL. So that with reference to the herring coming back it will take some considerable time for lake trout to grow even with them spawning, wouldn't it? What has developed with reference to that in Lake Michigan, which is entirely inside and not on the Canadian border at all? I am referring to the food situation.

Dr. MOFFETT. The food of lake trout?

Mr. WEICHEL. Yes.

Dr. MOFFETT. It has been good. We have seen no evidence in the commercial take, for instance, of herring and chubs that would indicate they were disappearing. In fact, the catches in the past few years, with the lake trout out of the picture, have soared. The fishermen are catching the herring which was formerly food for the lake trout.

Mr. WEICHEL. In previous years you had a shortage of herring.

Dr. MOFFETT. It could have had some effect but not with reference to the total disappearance.

Mr. WEICHEL. What about the disappearance of herring over in Lake Erie back in 1940?

Dr. MOFFETT. I can't answer that entirely, sir. I don't know.

Mr. WEICHEL. Leaving Lake Michigan and the shoreline of Lake Michigan out, with reference to the Province of Ontario, which touches all of the Great Lakes, the shoreline of Canada is about 2 to 1 over the American?

Dr. MOFFETT. It would be about 50:50.

Mr. WEICHEL. If you take Lake Michigan out?

Dr. MOFFETT. If you take Lake Michigan out.

Mr. BONNER. I understood you to say you thought there should be some mutual participation in the taking and selling of fish from the Lakes. Would you recommend that in a future appropriation, showing our good faith with a limitation to be put on the appropriation, providing that the Canadian Government shows good faith and operates in a conservation movement for the restoration of this area?

Dr. MOFFETT. Morally, that is a fine thing, but to execute it might be difficult.

Mr. BONNER. It strongly calls it to their attention.

Dr. MOFFETT. It is a question of good faith or not. I think the language would be there, but I would not personally say that a limitation made by this country could be made subject to the behavior of Canada.

Mr. BONNER. You have not been able to move them any other way in Canada. It is an industry that Canada is interested in as it is an industry we are interested in in the United States, so it has to be a cooperative arrangement.

Dr. MOFFETT. They want to cooperate, very definitely. One thing that is standing in their road is the treaty that is now up for consideration. They fear to move for fear it will jeopardize the chances of it passing.

Mr. WEICHEL. That would jeopardize our giving them a dollar and getting back a penny.

Mr. BONNER. I think we should have Mr. Day and a representative from the State Department to discuss that treaty business, but I am trying to work out something that will promote better understanding and better cooperation between the two Governments with respect to the question.

Dr. MOFFETT. On a technical level cooperation could not be any better, unless Canada could spend more money and share up in more of the work.

Mr. BONNER. The technical cooperation is one thing. You are stopping the industry on the American shore and permitting it to operate on the Canadian shore, with an American market as a Canadian operation.

Dr. MOFFETT. That is correct.

Mr. BONNER. I don't think that is fair.

Dr. MOFFETT. The States pass the laws. They regulate the fishery. We have no authority there except as to recommend when to do so.

Mr. BONNER. I thought this fund ought to motivate some agreement between the two Governments.

Mr. WEICHEL. With reference to the cooperation, you don't need those treaties or you don't need money, if the Canadians are not interested themselves by protecting the fisheries themselves. That does not cost money. In other words, they, themselves, to protect the fisheries for themselves, have to take fish 365 days out of a year. You don't have to have a treaty to do that. There isn't a State of the Union on the border of the Great Lakes that doesn't have laws to protect the fish. You don't need a treaty for that. They have not cooperated. They have not done anything to protect their natural resources on their own shores. Then, that doesn't cost money to say they are not going to take them during the spawning season like we don't take them.

Dr. MOFFETT. You are assuming that that is by its own nature a protective measure. There is question of doubt.

Mr. WEICHEL. I hope this, that if every State bordering on the Great Lakes has restrictions as to when you can take fish and that is on the advice of something from the Federal Fish and Wildlife Service and the conservations of the various State departments over the past 50 years, that there may be some good, then we are just foolish for doing that over these years, aren't we?

Dr. MOFFETT. Yes, sir.

Mr. BONNER. Doctor, would you recommend limitation of taking in these fish caught out of season?

Dr. MOFFETT. I cannot give you an official statement on that.

Mr. BONNER. As Mr. Weichel says, from a conservation standpoint.

Dr. MOFFETT. A good share of the Canadian imports during the spawning period comes from lakes other than the Great Lakes.

Mr. BONNER. Would they have a market if the American market was closed?

Dr. MOFFETT. Oh, yes. We don't produce enough fish even under normal circumstances to fill the demand for lake trout.

Mr. BONNER. I understand that but would the Canadian taker have a market for his take if the American market was closed?

Dr. MOFFETT. If the American market weren't closed during a given season?

Mr. BONNER. Was closed.

Dr. MOFFETT. Was closed?

Mr. BONNER. Would he have a market for his take?

Dr. MOFFETT. I think so.

Mr. WEICHEL. Where would they sell it? They sell 90 percent of their share in this country.

Dr. MOFFETT. Yes, sir, and a good portion goes into frozen foods. It is frozen and stored.

Mr. WEICHEL. Ninety percent of their catch goes here and the take is priced so low that American producers cannot compete. That also goes for salt water fish. The tariff comes in so tied up by the trade treaties made by the President that the Tariff Commission can't do anything about it with reference to the importation of foreign fish from every country. Fresh and otherwise, it is so low that the Ameri-

can fisherman can't compete. He cannot produce it. Yet we are going to spend money so they can bring in more. That is the way it is now. I am glad Mr. Bonner brought that up. The tariff is so low you cannot do anything about it on the New England coast, the west coast and everywhere else.

Mr. BONNER. We protect our bass and other fish in a similar manner. That is why I was wondering whether we could bring something out to bring about better cooperation.

Dr. MOFFETT. You never considered regulation of fresh-water fish when you compare them with the regulations that existed 15 years ago in most States. They took off size limits and creel limits and they took them off during the spawning period. They figure it is better not to. If you don't hack them out you won't get any big ones.

I don't want to waste your time.

Mr. BONNER. You are not wasting time. I am interested in getting some kind of cooperation.

Mr. ALLEN. Isn't it true, Dr. Moffett, that we have come so far with the wildlife investigation into methods of killing off the sea lamprey to the extent of three-quarters of a million dollars, that for an additional one, two or three hundred thousand dollars we will perfect the method and at that point it will probably be the time to do the bargaining with Canada and limit our expenditures to a condition that was equivalent to the amount they expend?

Dr. MOFFETT. That is what we planned. The only reason we are dabbling in possibilities is that it takes quite some time to make these various formal exchanges between countries and we just want to get our thinking straight. I am sorry we were caught, so to speak, without our thinking straight on this international-cooperation deal.

Mr. BENNETT. Would you make a recommendation to the State Department on this matter?

Dr. MOFFETT. It may be done directly but I think we have a voice in what it is.

Mr. BENNETT. How does the State Department arrive at what is needed in conservation?

Dr. MOFFETT. They are advised by the Fish and Wildlife Service.

Mr. BENNETT. If you advise them, would you plan, after this inquiry we have had today, to also advise them to look into the possibility of asking Canada to consider similar arrangements on the taking of the fish and selling of them during the spawning period?

Dr. MOFFETT. Yes, sir. As a matter of fact, the matching of regulations between the States and the Province of Ontario is getting better as time goes on. Recently Michigan lifted the ban on taking sturgeon. We have been protecting sturgeon for 40 years, while on the Canadian side there had been no protection. It is our decision as a country and the State of Michigan that there wasn't much sense in that thing. We may as well let our fishermen take the sturgeon. The Canadians didn't hurt them so we figured our fishermen wouldn't hurt them either. That is getting much more sensible than it used to be.

Mr. BONNER. Is that river sturgeon?

Dr. MOFFETT. Yes, sir, it is similar to the ones you find in the Columbia River and in fresh water.

Mr. WEICHEL. They sell at $2 a pound.

Dr. MOFFETT. They get up to as much as 700 pounds.

Mr. BENNETT. Who makes the determination when you go to Canada and try to make an arrangement with Canada on a conservation issue? Who takes the position for the United States on a certain thing that is beneficial for conservation? Does the State Department do it or do you do it?

Mr. MOFFETT. The State Department has to do it.

Mr. BENNETT. Where do they get their information?

Dr. MOFFETT. They get it from us.

Mr. BENNETT. Do they differ with what you say?

Dr. MOFFETT. I have never had any experience because I have never been in it.

Mr. WEICHEL. This treaty is something they don't have to have. They can just do it. They don't do anything about it. A treaty and all this business like that is the bunk. All they have to do is to do it. They don't have to have a treaty to do it. If they don't want to take fish all year around, all they have to do is stop doing it. You don't have to have an agreement with them. All they have to do is stop doing it.

Dr. MOFFETT. They do not believe that is a conservation measure and they are entitled to their own opinions.

Mr. WEICHEL. Yes, sir, and I think the time has come when the people of the United States should have a right to their own opinion.

Mr. BOYKIN. Gentlemen, are there any other questions?

Before you go, Mr. Weichel, we have our wonderful friend, Mrs. Church, and you all remember her husband, Ralph Church, served on this committee so long, and she would like to make a statement.

STATEMENT OF HON. MARGUERITE S. CHURCH, MEMBER OF CONGRESS FROM THE THIRTEENTH DISTRICT OF ILLINOIS

Mrs. CHURCH. Mr. Chairman, I am happy that you gave me this opportunity to express the hope that an appropriation will be continued for the control of the lamprey eel in the Great Lakes. Because the Illinois Department of Conservation and the Illinois Commercial Fisheries Council have not sent a representative I gladly accept the responsibility of testifying, because I represent that section adjoining the lower part of Lake Michigan, particularly the city of Waukegan, which has suffered such a tremendous loss in its commercial fisheries because of the lamprey eel.

I am going to ask that the letter of Mr. Leonard Schwartz, director of our department of conservation be included in the record.

We have seen in Lake Michigan a decline from 7 million pounds of fish to less than a million pounds taken per year; and in that section of Lake Michigan which comes below Illinois we have seen a decline from 1,100,000 pounds to less than 400,000 pounds per year.

I was interested in the question of the gentleman on your right. I am wondering if the explanation was that part of the loss might be due to the decline of food for the trout. I, personally, have studied the depredation caused by the lamprey eel. I have seen barrels of fish brought in, not only trout but other fish in our area, lacerated by the lamprey eel and the culprit still hanging on, even though it had sucked out the life's blood. There is striking evidence that in Illinois the decline has actually been caused by the lamprey eel.

There seems to be an indication of improvement in the last few years. We have had some trout come back to our section, but we are convinced that even an economy-minded Congress should see it to be a part of economy, to consider a proposal which would remove this danger, which is in addition destroying the food supply of a large section of our people.

I would certainly hope that the appropriation would be granted and that this committee will throw its weight behind a further enlargement of activity in checking to find other methods than the one now proposed for the control of the lamprey eel.

(The chairman left the room and Mr. Bennett assumed the chair.)

Mr. BENNETT. Without objection, this letter will be made a part of the record.

(The communication referred to follows:)

STATE OF ILLINOIS,
DEPARTMENT OF CONSERVATION,
Springfield, February 1, 1952.

Re: To be included in report of hearing, February 5, 1952, appropriation for sea lamprey work in the Great Lakes.

SUBCOMMITTEE ON FISHERIES AND WILDLIFE CONSERVATION,
Old House Office Building, Washington, D. C.
(Attention Frances P. Still, chief clerk.)

GENTLEMEN: I am very sorry that we of the Illinois Department of Conservation and the Illinois Commercial Fisheries Council will be unable to appear at this important hearing, but we would like to go on record strongly supporting the appropriation requests of the Fish and Wildlife Service for its investigation and management work on the sea lamprey in the Great Lakes.

We also wish to see an increased appropriation as soon as feasible that will allow the Fish and Wildlife Service to expand its operations to include Lake Michigan, as Lake Michigan alone has seen a decline in lake trout from approximately 7,000,000 pounds to less than 1,000,000 pounds of trout taken per year. The State of Illinois which owns a very small portion of the Great Lakes, although a very important fishing port, has had a decline in lake trout in its portion of Lake Michigan during the past 8 years from over 1,100,000 pounds to less than 4,000 pounds, not taking into consideration the damage done by sea lamprey to other species of fish.

We, in Illinois, are seriously worried about this menace entering the Mississippi Valley which includes the Missouri and Ohio Rivers and their tributaries.

It would be tragic not to appropriate the necessary funds to carry on work to control the sea lamprey and protect this important fisheries resource.

We will appreciate your concurring in these recommendations.

Respectfully yours,

LEONARD SCHWARTZ,
Director.

Mr. BENNETT. The chairman has left without telling us what to do. Does anybody want to testify upon this point? I don't think we can run much longer beyond this point.

Mr. ALLEN. Would Mr. Potter, or someone, introduce a bill to extend or grant another authorization after this year? Is there to be a completion of the hearing at this time? I point out that we have heard nothing of the costs or the prospects of the future.

Mr. BENNETT. I am sure we have not concluded. I think we can meet again this afternoon. A number of us have to be at another meeting for about an hour.

Mr. POTTER. If I could, in answer to Mr. Allen's question, it was my intention for the committee to hear the testimony of the witnesses that are here. Based upon their testimony here I, or the chairman of the committee, or whomever he sees fit to do so, will then introduce a bill and act upon that legislation.

As you recall, last year we discussed this problem that it would cost more and we recognize more than the original authorization but it would be based on a period of time so the Fish and Wildlife Service could come in and report on the basis of our testimony here, and I am sure they are in a position to go into the question of cost quite thoroughly, as they have with me, and on the basis of that, a simple bill can be introduced to have the committee continue the authorization.

Mr. BENNETT. Of course, the committee asked that they come back and make the report and I think, myself, we should have a full hearing on what you have done, although it might be repetitious. We are anxious to get something done, even though this committee has not met much this year. It would be my recommendation to adjourn and come back at some propitious hour.

Mr. POTTER. I understand that is all there is and the House will adjourn at 1:30.

Mr. BENNETT. Why don't we reconvene at 2 o'clock?

Mr. POTTER. There are some people who have to return tonight so it will be well if we might have Claude Ver Duin and Mr. Swift to give their statements because they have to leave.

Mr. BENNETT. I have been told that 2:30 would be all right.

Mr. WEICHEL. Then we will have hearings on the legislation?

Mr. BENNETT. This will reduce somewhat the hearing on the legislation.

Mr. POTTER. What the legislation will do is increase the present authorization; just amend the present act to increase the authorization from $300,000 to whatever amount is requested and based on the testimony they give this committee, and this committee in its wisdom can determine the amount.

Mr. BENNETT. Is there any other statement any of you gentlemen wish to make? If not, we will adjourn until 2:30 today.

(Whereupon, at 12:10 p. m., a recess was taken to 2:30 of the same day.)

AFTERNOON SESSION

Mr. BOYKIN. Gentleman, shall we come to order?

I understand with respect to The Fisherman, from Grand Haven, Mich.—I have gotten a lot of pleasure from that magazine—the editor has to go home. Also Dr. Leonard.

We will hear from the managing editor of The Fisherman, Grand Haven, Mich.

STATEMENT OF CLAUDE VER DUIN, MANAGING EDITOR THE FISHERMAN, GRAND HAVEN, MICH.

Mr. VER DUIN. Mr. Chairman, gentlemen; the capacity that I am here in today is as the official representative of the commercial fishing industry of Michigan, Wisconsin, and Illinois. It was originally intended that as a representative of the industry I should speak last. If that plan had been followed you would have had the advantage of Dr. Hile's statistical report, Dr. Moffett's report, in which he would review the problem as it existed, the investigations that have been made, the results that they have obtained, and an outline of their proposed program.

I will now have to change my approach to this a little bit because you have not had the benefit of all of that information. In behalf of the industry I want to point out that for many years the industry and the Fish and Wildlife Service did not see eye to eye on very many subjects. So when these men came into the picture to take over this investigation of the sea lamprey they were coming to work with an industry that had been very critical of their agency for many years. We watched their operation very critically at all times.

I can only report that we were amazed at the very practical approach that they took to this problem and the efficient manner in which they have conducted their investigations. We believe that these men—Dr. Moffett and his associates—have done a remarkably fine job of this investigation of the sea lamprey, and the development of these proposed controls which they will present to you this afternoon. The industry is wholeheartedly behind these men in this program and we hope that you——

Mr. BOYKIN. Did I understand you to say that you represent three States?

Mr. VER DUIN. Yes, sir. We hope that you people in Washington will go along with these men for another year so that this program that has been brought so nearly to completion can be finished.

During the course of their testimony you are going to hear a lot about fish and you are going to hear a lot about lampreys. There is only one other group that I would like to call attention to, and that is the people in this industry who are involved.

Dr. Hile pointed out this morning that the industry is losing better than $5,000,000 a year as a result of the disappearance of the lake trout due to the sea lamprey. Our fishermen were very, very depressed over this, and as a result of the investigations and what has been found there is now back in the industry a little spark of optimism. We hope that this can continue, that this control program can eventually be put into being, because we believe that these men are on the right track.

So my main purpose in coming down today was to tell you that the industry is well satisfied with the work that these men have been doing and to ask you men as our representatives here to go along with them to complete this cycle of scientific investigation which is now so near the end.

Mr. BOYKIN. How long do you think it will take to really complete it?

Mr. VER DUIN. On the basis of what these men have told us, they believe that this next fiscal year, if they can go along with the plan as they propose it, as you will hear it this afternoon, they will then have completed their scientific research and will be in a position to say this is the solution.

Mr. BOYKIN. This is the solution?

Mr. VER DUIN. Yes, sir.

Mr. BOYKIN. Do you think they will have the solution?

Mr. VER DUIN. Yes, I believe they will. I have seen these various units that they are talking about in operation, in the streams, and they are doing all that they claim for them.

Mr. BOYKIN. Where are these eels going? How far down do you think they have gone?

Mr. VER DUIN. In what lake, sir?

Mr. BOYKIN. I would say south.

Mr. VER DUIN. All of Lake Michigan has been taken over by the lamprey. The question was raised once today about whether the loss of the trout could be attributed directly to the lamprey. We believe it can be. In the Lake Michigan situation the lamprey had to come in through the Straits of Mackinac, and it did. It came in through the Straits of Mackinac and gradually began to work southward.

The spread of the sea lamprey through the Straits and southward down Lake Michigan was in direct correlation to the disappearance of the lake trout. As the lampreys extended down, the trout disappeared. Now they have gotten up into Lake Superior.

These gentlemen will tell you today that the work that they are doing now and propose to do will be concentrated largely on Lake Superior, where there is still something of the trout resources to save.

Mr. BOYKIN. Are there any questions, gentlemen?

Mr. ALLEN. Mr. Chairman?

Mr. BOYKIN. Mr. Allen.

Mr. ALLEN. I can see without much argument why a Federal agency would be justified in going in and making a scientific study and establishing the scientific facts that are involved, and getting some remedy to this lamprey situation. But I would see a different situation in the future, after they have reached a solution, in having Federal funds support an activity which is of benefit primarily to a single area.

Have you given any thought in the industry around the Great Lakes as to how a control program of a permanent nature should be carried out and financed?

Mr. VER DUIN. We recognize that when it comes time for the control program to be actually instituted it would be asking a lot for the Federal Government to carry the burden. We believe in the industry that we also have an obligation there. We believe that the States have an obligation.

We have discussed it at our meetings, and our people are of the opinion that when the control program is set up, the responsibilities for carrying out the actual control is designated, and it comes time to share in the cost, the industry most certainly will have to take some sort of a tax in order to contribute its share.

We feel that the States like Wisconsin will come in with their share.

Dr. Leonard is here from the State of Michigan and can probably speak better for the State.

Mr. BOYKIN. We will have Dr. Leonard next.

Mr. ALLEN. Have you given any thought to what type of organization, if any, will be required in the area to coordinate the activities of the industry and the States?

Mr. VER DUIN. No, we really haven't given any thought to that. We feel that that is something that is going to be handled by the Fish and Wildlife people in the States primarily. The industry will probably be called in and consulted on it. We are willing to go along with most anything that is set up because we are in desperate shape.

Mr. ALLEN. I have noticed since I have been here that the Atlantic coast fisheries got into agreement finally with a commission formed by representatives of the various States along the coast. Subsequently the California-Washington-Oregon people instituted a similar regional

commission, and the Gulf States have done the same thing, apparently as an improvement in handling an interstate problem which was not in general a national problem.

I was anticipating the difficulty that we might have in going up around the Great Lakes. I wanted to be sure we didn't overlook that phase of the problem.

Thank you, Mr. Chairman.

Mr. BOYKIN. Mr. Weichel?

Mr. WEICHEL. Mr. Ver Duin, since 1926 there was supposed to have been a study as to the very thing that you are talking about, depletion of the fish in the Great Lakes, starting in 1926 with an appropriation of $25,000, which has increased.

I will ask the Fish and Wildlife people how much it increased since then, and how much was spent on that, and headed by Mr. Van Oosten, which was supposed to cover the depletion of fish. Lake trout is a fish. With reference to the eel and everything else.

After 24 years all that came up out of that was to give control to somebody else. If we are going over the same thing again, I would like to know it. Do you know about that?

Mr. VER DUIN. Yes. I was not aware of the fact that they ever had the amount of money that you have indicated.

Mr. WEICHEL. It began with the appropriation in 1926, the first appropriation with reference to the lessening of the catch of herring. Then the Fish and Wildlife people came up with the statement that they needed a group to study it. That is what they have been doing all these years.

Now you speak of depletion of lake trout. I wonder how familiar you are with that.

Mr. VER DUIN. I was always under the impression, Congressman, that the Fish and Wildlife people for many years, starting back in 1926 or thereabouts, with the disappearance of the cisco on Lake Erie, became active in this picture of research, but it was always my impression that they operated on a very limited budget, for many years permitting them as little as $2,000 above actual salaries with which to conduct an investigation for an area as large as the Great Lakes.

Mr. WEICHEL. Did they spend all this money on salaries all this time?

Mr. VER DUIN. No, sir. They have had very small staffs in the lake region until 1946 or 1947 when they came down before this committee and I think at that time they were given about $20,000 a year, the first time that they had had a sizable amount of money to use in research. That was spent largely upon the sea lamprey work.

That, as I understand, went along for a couple of years on the $20,000 level, and then was increased in just the past 3 years. The Fish and Wildlife Service on the Great Lakes has not been a highly financed proposition up until just a few years back.

Mr. WEICHEL. We have had people sitting around there for 25 years. I don't know what they have been doing.

Mr. BENNETT. Maybe he can tell us. Do you mind my interrupting? You say exclusive of salaries they got $2,000 for research.

Mr. BOYKIN. You couldn't do much on that.

Mr. BENNETT. I would like to ask, what were the men doing who were drawing the salaries?

Mr. VER DUIN. These men, from my observation of this thing, they had several men in the field—probably two men in the field—who went along very often with the commercial fishermen, examined their catches, took scale samples to determine age and things like that, and then they had a man or two, or probably a woman in the office, who did a lot of statistical work based upon the monthly reports that are filed by the fishermen, so that they could follow the trends, the production trends, and things like that.

They never had a real staff in the Great Lakes area until 1946, with the exception of a couple of years when they did operate a research vessel on Lake Michigan. I cannot say offhand what years those covered, but they did for several years operate a research vessel in which they studied principally the chubs of Lake Michigan.

Mr. BENNETT. From what you have been able to observe, would you have any conclusions that you could make as to whether or not the expenditure for salaries was justified? Or are you in a position to say, one way or another?

Mr. VER DUIN. I would think that the Fish and Wildlife people have done a good job with the amount of money that has been given to them, to investigate and to recommend for an industry as large as the Great Lakes. There certainly was never any sizable amount of money spent. We think the results were good.

Mr. WEICHEL. Where are the reports on the depletion of fish for the last 25 years? If they did not do just a tiny bit in 1926—there were no reports that came before this committee as to what they did in the last 25 years, even with those four people up there.

Mr. VER DUIN. There are any number of scientific papers that have been released showing what they have done in connection with these various fishery investigations.

Mr. WEICHEL. In 25 years, with reference to the Lake trout, they certainly could have learned something if there was just one man walking around with crutches all that time.

Mr. VER DUIN. I think they did.

Mr. WEICHEL. It never came before this committee. You know about the hearings that they had there in 1944. You came to them.

Mr. VER DUIN. Yes; I was there.

Mr. WEICHEL. The testimony is not as you are saying now.

Mr. VER DUIN. No, sir. We did not see eye to eye with the Fish and Wildlife people.

Mr. WEICHEL. What I am talking about is that they did not do anything. How much money do we have to invest before they do anything? Do we have to invest a million dollars, or four or five million dollars?

Mr. VER DUIN. I feel that the men that we have working in the field today have a different approach to this than some of their predecessors.

Mr. WEICHEL. That is what they thought for 25 years, up to 1946. Just exactly what you are stating about these people.

I want to know if it is any different. That is all that I have.

Mr. BOYKIN. Thank you very much, Mr. Ver Duin.

We will now hear from Justin W. Leonard, research administrator, Michigan Department of Conservation, Lansing, Mich.

STATEMENT OF DR. JUSTIN W. LEONARD, RESEARCH ADMINISTRATOR, MICHIGAN DEPARTMENT OF CONSERVATION, LANSING, MICH.

Dr. LEONARD. First of all, I should like to indicate my gratitude for the opportunity to present a statement on behalf of our department, and particularly to express my appreciation for the privilege of presenting it at this time so that I can meet travel schedules.

Mr. BOYKIN. We held a special meeting for you this afternoon. Our chief clerk told us that you and Mr. Claude Ver Duin want to get back. We want to help in any way we can.

We know what good work you have done and we know how important it is to get proper results.

Dr. LEONARD. Thank you, sir.

The Michigan Department of Conservation is appreciative of the opportunity to express its satisfaction with the excellent work being carried on by the Great Lakes investigations of the Fish and Wildlife Service. The personnel assigned to this activity have maintained close liaison with our organization, and we feel they have displayed praiseworthy courage and resourcefulness in their attack on the problem of seeking means for controlling the sea lamprey.

It may not come amiss to mention that, when this problem first arose, professional fishery scientists throughout the country inclined toward a strongly pessimistic outlook on its chances of solution. There were few who envied the Great Lakes staff what many considered an almost hopeless task. The fact that they are now, as I understand, able to present to you a little later methods which do give grounds for optimism far exceeds general expectations.

Through its fish division, the Michigan Department of Conservation has maintained a keen interest in the progress of the sea lamprey's depredations, and in the program for its control. In the first 2 or 3 years immediately following World War II our organization carried on some of the basic research on the sea lamprey's life cycle—Dr. Vernon Applegate was then a member of our staff—and devoted much time of its field employees, especially those within the divisions of fish and field administration, to learning what streams of the State supported spawning runs of lampreys, and to determining the extent of marking of fish in the commercial catch.

Representatives of our organization who have appeared before this subcommittee in previous years have outlined adequately the reasons why we feel the sea-lamprey-control program and the research underlying it can best be undertaken by the appropriate Federal agency. Our fishery activities are supported entirely by the sale of licenses, and the only sales which contribute significantly to our revenue are those for sport fishing on inland lakes and streams.

Revenue from sale of commercial fishing licenses amounted to only $51,499.65 in fiscal 1949–50, not even enough to cover costs of regulating the industry. Hence we feel our compelling responsibility is to the sports anglers on inland waters.

There is the realization, too, that Great Lakes fish population do not recognize political boundaries. Collection of the scientific data essential to an intelligent approach to the problem, on an interstate and international basis, is more properly the province of a Federal than of a State agency, in our view.

During the past 5 years Michigan has cooperated with the Fish and Wildlife Service by conducting investigations designed to supplement theirs, and this cooperation is continuing. The sum specifically budgeted for this purpose, $10,000 per year for the past 2 years, may seem comparatively small in comparison with the operating costs of the Federal program.

However, cooperative effort not specifically budgeted has probably cost us at least as much more, even though it does not appear separately in our bookkeeping, and represents, we believe, the maximum expenditure proper in view of our primary responsibility to inland fishermen.

What action the Michigan Legislature may take toward implementation of a control program, once a practical and economically feasible method has been developed, is not for me to predict. In view of past expressions of interest and concern by members of the appropriate committee of our legislature, it seems certain that such a program would receive prompt, thoughtful and favorable consideration.

Thank you, sir.

Mr. BOYKIN. Thank you. That was a good statement.

Gentlemen, are there any questions?

Mr. ALLEN. Dr. Leonard, the last statement that you made with reference to the Michigan Legislature, of the committee being probably favorable in its action, is it possible in your estimation that this problem could be handled State by State, without a much more formal organization, and that would be intrastate?

Dr. LEONARD. That is a question we can hardly answer certainly on the basis of scientific knowledge. We simply do not know enough yet about the habits and behavior of the commercially desirable fishes in the Great Lakes to know where they range.

It would be my guess that there would need to be some coordination of effort. One of the primary reasons why we felt this was a proper sphere for Federal operation is the fact that interstate waters are involved. On the other hand, speaking as a private citizen, I think it is very likely that the legislatures of any of the States involved may take favorable action because the people of their own States are involved. No one can predict what will happen.

Mr. ALLEN. Is there any existing organization, either legally composed or informal, that does coordinate the efforts of the various States that might be involved and that would be adequate to coordinate this activity?

Dr. LEONARD. I am not certain, sir, whether the existing sea-lamprey-study committee would be legally empowered to operate on a control basis. It was organized, as has been brought out, primarily to interchange information on the problem itself and on the methods to attempt its biological control.

So far as experience is an indication, we have been able to get together with the people in Wisconsin for the joint enforcement of sport fishery regulations on our boundary waters. We have a number of waters that are both in Michigan and Wisconsin. We have been able to harmonize our interests there.

Mr. ALLEN. Thank you.

Mr. BOYKIN. Mr. Weichel?

Mr. WEICHEL. Michigan in the last 2 years has only spent $10,000?

Dr. LEONARD. Per year.

Mr. WEICHEL. That is with reference to the study on this?

Dr. LEONARD. That is right.

Mr. WEICHEL. Although the depletion of lake trout has been going on since before 1940 in Lake Huron.

Dr. LEONARD. My feeling is that the depletion that appeared due to the sea lamprey started earlier than that.

Mr. WEICHEL. How long have you been with the Department?

Dr. LEONARD. Since 1934. During the years you are speaking of, I was occupied in the Pacific.

Mr. WEICHEL. You have not been in the State of Michigan then from 1934 until when?

Dr. LEONARD. Until the present, with time out for war service.

Mr. WEICHEL. I am talking about 1934.

Dr. LEONARD. Yes, sir.

Mr. WEICHEL. You have been from 1934 until when? Have you been there from 1934 to 1942?

Dr. LEONARD. 1942.

Mr. WEICHEL. Before 1942 the depletion of lake trout was going on then. They were talking about it commercially and with reference to sport fishing.

Dr. LEONARD. I know that, so far as we were concerned in our Department, we were not at that time confident that the decline of the lake trout fishery was due to the sea lamprey. That was a relatively new thing. In fact, I believe there are people within our State who still question whether it is the sea lamprey that is responsible for the decline in the fishery.

Mr. WEICHEL. What I am getting at is that the State of Michigan has as much shore line, to have as much interest in the lake trout, more, more than all the rest of them put together. They have not put much attention to it until, as you said, last year, although it has been going on since—I have heard them talking about it since 1940. It is interesting that they, having so much at stake, that there has not been anything done at all by the State.

Dr. LEONARD. The reason is in my statement, Congressman, the fact that we are confined to operation on sport fishing money.

Mr. WEICHEL. They have much at stake, with three lakes involved—Lakes Michigan, Huron, and Superior—yet according to the chart Lake Superior has increased its production of lake trout, and Lake Michigan evidently, and going back to 1940, with reference to the three lakes, in which they have great interest, I was interested in when they first took notice to the tune of $10,000. The total income that the State gets out of the industry is $51,000 a year.

What have the other States done? I talked of the study of the Great Lakes fishing industry running back, with a special group in the Fish and Wildlife, back to 1926, covering lake trout and other fish. They have not made much of a report or submitted anything to this committee over those years.

With reference to the other States, what have they done in the way of money? Michigan gave $10,000 for 2 years out of 14. What have the other States done?

Dr. LEONARD. I do not know. I know there has been some work going on in Wisconsin. How much it costs them I do not know.

Mr. WEICHEL. There is such a thing as Council of State Governments for the States themselves, where they can enter into agreements among themselves with reference to their own boundaries. I am not talking of pacts on the Atlantic or Pacific coasts. Those are Federal waters.

But these are State-owned waters. The Federal Government has nothing to do with them at all, no proprietorship. The States have all the jurisdiction in the water, the lands under it, and the wildlife in it.

Michigan is one of the greatest States there. What have the other States done with reference to the States involved as to making agreements, which they can do through the Council of State Governments?

Dr. LEONARD. That is within the field of our legislature.

Mr. WEICHEL. They did, through the same vehicle, after 24 years, a certain group came up with an idea to give control to a commission of four people: Two Canadians and two Americans, to control the whole business. They did that but they didn't do anything themselves with reference to the same problem which they could do under the laws of the various States.

Do you know anything about that?

Dr. LEONARD. No, sir.

Mr. WEICHEL. At least you have not heard anything about it from 1934 until the time you went into service in 1942?

Dr. LEONARD. That is right. As I say, our concern with the commercial fisheries has been comparatively slight, by definition of our authority.

Mr. WEICHEL. You were there from 1934 to 1942. Then you went away. When did you come back?

Dr. LEONARD. I was away from 1942 to 1946.

Mr. WEICHEL. Hearings were held in 1944. There was testimony at Blaney Park, Bay City, Mich., and various other places. I wonder what the State had done in the meantime in agreement with the various States. Is there anything that you know about that?

Dr. LEONARD. No, sir.

Mr. BENNETT. Might I ask if Michigan has a commercial fisherman's commission, comparable to the one that you were connected with?

Dr. LEONARD. No, sir. We do not have a separate agency as such.

Mr. BENNETT. Have you ever had one?

Dr. LEONARD. Not to the best of my knowledge. Mr. Ver Duin can verify that. I do not believe so. The commercial fishery in Michigan, certainly, is made up primarily of small individual operators. There are very few multi-million-dollar corporations involved. They are mostly small-business men.

Mr. BENNETT. Do you have any regulations as to the size of the nets, meshes, and things of that nature?

Dr. LEONARD. Yes, sir, we have. I cannot give you that out of my head.

Mr. BENNETT. Who enforces the law?

Dr. LEONARD. We enforce the law. That is where the bulk of this $51,000 that I spoke of, which we take in from commercial fishing licenses, is expended. It is in that regulation of the industry which the industry itself feels is desirable.

Mr. WEICHEL. Was there not a contention for a number of years with reference to the so-called rule that Dr. Van Oosten invented and got the State of Michigan to adopt, that it was because of that that there was a depletion of fish?

Dr. LEONARD. I could not tell you that.

Mr. WEICHEL. You did not read those hearings?

Dr. LEONARD. In those years I was a much more carefree man than I am now.

Mr. BOYKIN. Thank you very much, Doctor.

Now we will ask Mr. R. W. Eschmeyer to come forward.

STATEMENT OF R. W. ESCHMEYER, ASSOCIATED FISHING TACKLE MANUFACTURERS, AND EXECUTIVE VICE PRESIDENT, SPORT FISHING INSTITUTE, WASHINGTON, D. C.

Mr. ESCHMEYER. I am R. W. Eschmeyer, executive vice president of the Sport Fishing Institute right here in Washington. That is new, and I do not think any of you have heard of it, so may I identify myself a little further?

Mr. BOYKIN. Yes.

Mr. ESCHMEYER. My work is fish conservation strictly, and fishing. We are not a pressure group. We are a conservation group.

As for background, my own training was in northern Ohio. My wife was born on the Sandusky River—not on it, but near it. That gets down your way. I was consultant for your Wildlife Management Board, with that $9,000,000, on warm-water fish in California.

I was on the VPI faculty to put up the first doctorate on fish. I live in Virginia now and spend a couple of weeks as an outside specialist looking over your things in Florida and to make suggestions.

Mr. BOYKIN. How far do you think the lamprey eels have gotten down?

Mr. ESCHMEYER. They have not gotten down your way yet, sir.

Mr. BOYKIN. Somebody said they were down in the Tennessee Valley and had a picture in the paper.

Mr. ESCHMEYER. That is not that kind. That is a different kind.

Mr. BENNETT. If they ever go to Florida they will never go back.

Mr. ESCHMEYER. I have been a person complaining of Government spending, as a citizen, as much as anybody. I am urging you to spend more money on the Great Lakes. It doesn't make much sense but there is a reason for it. One, our sport fishing, which is worth much more now than the whole commercial fishery of the United States, is in jeopardy. We have over 20,000,000 fishermen. One-seventh of the population fishes. If you have to have it in dollars and cents, it is over a billion-dollar industry in costs expended, and it is worth more than the commercial.

But the catch per trip is going down. It is down to less than one an hour now, and the fish caught are small. More and more people have to go off the big waters and on the big waters. The Great Lakes and oceans take care of the fishermen now.

The lamprey has ruined it for the fishermen. We have no arguments with the commercial fishermen at all. We need both. But we do not have the sport fishing. Our lake trout trolling is gone. One of our important areas doesn't give the sport fishing it should.

We do not even know—so little has been done—as to how much fishing there is on the Great Lakes. We know that Door County, alone, in Wisconsin, has 3,000,000 man-days a year of fishing in that one county. It runs into the millions.

There hasn't been enough work done to get figures. I am urging you in this case—it is unusual, and I think we spend too much—I am urging you to spend this little bit for this study. You might say, Why do the States not do it? The States, except in California, do not get license money for sport fishing. California is doing a great job on its marine sport fishery because it charges a license. The other States are not doing much and will not. The minute they try it the people say, "We pay you a license inland, that is where your work will have to be."

This will have to be done mainly by Federals, as badly as we feel about Federal spending. That is an important thing. An important sport fishery that we need more and more is going to pot.

I do not think in terms of a billion dollars a year. I think sport fishery in terms of another angle. We are living too fast and have to relax. A fellow who can get away from it and go fishing will live a little longer.

My interest is human conservation. There is another reason why I want to get this in, just this one word: In my profession we have all sorts of people. It is new. It is like medicine was in the Dark Ages. I agree with the Representative from Ohio about the past of the Service up there. We have been unhappy about it. In these two men, Dr. Moffett and Dr. Hile, you have, in my opinion, two of the top men in my field. If we do not back that type we're not going to get very far.

That is behind it. I owe them nothing, they owe me nothing. I haven't a thing to gain whether the fishing is good or bad on the Great Lakes. It does not concern me in the least. The way to better Federal employment is when you have good men. Back them up and forget the other kind.

Thank you, gentlemen.

Mr. BOYKIN. Are there questions?

Say, have you ever been to Alabama?

Mr. ESCHMEYER. I lived in Tennessee. I was in Alabama on the TVA lakes a lot, and I know Swingel. I worked with him closely in school.

Mr. BOYKIN. If you had been to these other places and did not go to Alabama, and did not expect to go to heaven, you ought to come to Alabama. It is the next best place to it.

Mr. ESCHMEYER. My parents did not know that the future lay in the South, and I was born in the North.

Mr. WEICHEL. I understand that there is something free for sports fishing, that they do not charge for fishing in the Great Lakes.

Mr. ESCHMEYER. That is right.

Mr. WEICHEL. What States are free? The waters are owned by the various States. If the State does not want to charge anybody for fishing in the lake, that is the same as fishing in the inland lakes.

Mr. ESCHMEYER. They do not do it.

Mr. WEICHEL. What States do not do it? I am talking of the Great Lakes.

Mr. ESCHMEYER. The same thing applies to the ocean. There is almost nothing done for fishing.

Mr. WEICHEL. In what lakes do you not have to pay a license to fish?

Mr. ESCHMEYER. Every one of them in the Great Lakes.

Mr. WEICHEL. What I am getting at, you pay to fish in the Great Lakes. You gave me the impression that there is no license fee to fish on the Great Lakes.

Mr. ESCHMEYER. There is not, for sport fishing. That is why the States——

Mr. WEICHEL. For your information, there is on Lake Erie. I never heard of any other place.

Mr. ESCHMEYER. I have the laws in my pocket—I left them at the office. I do not believe so.

Mr. WEICHEL. There is for Ohio, because you have to have a fishing license to fish in the waters of the State of Ohio.

Mr. ESCHMEYER. But not in the Great Lakes, I do not believe.

Mr. WEICHEL. The Great Lakes is part of Ohio.

Mr. ESCHMEYER. You need that in Michigan, too, but not on the Great Lakes. They make exceptions. Ohio has, I believe, the greatest fishing laws in the country.

Mr. WEICHEL. I am talking about the State of Michigan. If they own the water and they do not charge any license to fish out there, that is very interesting. But other States charge for fishing in the waters of the State.

Mr. ESCHMEYER. Not the Great Lakes waters. They do not on the ocean.

Mr. WEICHEL. The ocean is not State waters. Those are Federal waters.

Mr. ESCHMEYER. But these bays do not, either. We can go out in the Potomac and fish.

Mr. WEICHEL. I do not know about the free business.

Mr. ESCHMEYER. I believe you will find it is free in every State on the Great Lakes. You fellows kept up on that.

Mr. WEICHEL. In Ohio you pay to fish in the waters of the State of Ohio. I pay it myself.

Mr. ESCHMEYER. Not for fishing in Lake Erie exclusively, you do not. I think that is unfortunate, sir. If we had to pay a license fee, then we could say we are paying a license, do something on the Great Lakes.

Mr. WEICHEL. There is no Federal license to fish?

Mr. ESCHMEYER. No; there should not be.

Mr. WEICHEL. You were indicating that something was free, that they should do it federally.

Mr. ESCHMEYER. No. The States do not get license money and they will put their money in where the licensed fishermen fish. That is not the Great Lakes. They fish free. That is why the States are not going far to help out the Great Lakes. They have to go where the licensed money is paid. That is inland. That is the only reason for that.

Mr. WEICHEL. I wish you would check up a little more with reference to the Great Lakes where they do not collect for fishing in the waters of the States.

Mr. ESCHMEYER. I think we have checked up. I have just checked the laws of every State in the United States. We are getting out a fishing guide. I am up on it pretty well. There might be a State on the Great Lakes, in the last year. If we were betting I would say 10 to 1 that that is not true, that they charge to fish on the Great Lakes exclusively.

Mr. BENNETT. We are not allowed to bet.

Mr. BOYKIN. Thank you very much.

Mr. Swift, director of the Conservation Department, Madison, Wis. Is he here?

(No response.)

Dr. MOFFETT. I have a letter from the State of Indiana that I would like to have read into the record.

Mr. BOYKIN. Very well. Without objection, it is so ordered.

Dr. MOFFETT. This letter is in response to an inquiry as to whether he would be willing to testify at the hearing:

INDIANAPOLIS 9, IND., *February 2, 1952.*

Mr. ALBERT M. DAY,
Director, Fish and Wildlife Service,
Washington 25, D. C.

DEAR MR. DAY: We have received a wire which is quoted as follows: "The Subcommittee of Fisheries and Wildlife Conservation will meet in open hearings February 5, 1952, at 10 a. m., room 219, Old House Office Building, to receive the report of the Fish and Wildlife Service concerning sea-lamprey work, and discussion of plans, procedures, and estimates of cost needed for the future. I understand that you desire to testify. Frances P. Still, Chief Clerk, Committee on Merchant Marine and Fisheries."

The department of conservation regrets that it cannot have a representative present at the above hearing; however, we desire to express our support for adequate funds to the Fish and Wildlife Service for the continuation of the important work being done on the sea-lamprey program in our Great Lakes. We would appreciate it if our support as designated in this letter could be presented by you or your representative at this hearing.

The Fish and Wildlife Service in cooperation with the various States of the Great Lakes system has already learned considerable about the biology of the sea lamprey and also much has been gained in the development of methods of control. Indiana, along with other States, in cooperation with the Service, has improved methods of trapping the sea lamprey on its way to spawn; yet a great amount of work is still needed to conquer the destructiveness of the sea lamprey on our Great Lakes fisheries.

Indiana hopes to continue to work with you on this problem, and we urge the continuation and expansion of the sea-lamprey control program.

KENNETH M. KUNKEL,
Director, Department of Conservation.

Mr. BOYKIN. Doctor, whom do you suggest we have as our next witness?

Dr. MOFFETT. I am the only remaining one.

Mr. BOYKIN. Then we will hear from Dr. James W. Moffett, Chief of the Great Lakes Fishery Investigations, Fish and Wildlife, Ann Arbor, Mich.

STATEMENT OF DR. JAMES W. MOFFETT, CHIEF, GREAT LAKES FISHERY INVESTIGATIONS, FISH AND WILDLIFE SERVICE, ANN ARBOR, MICH.

Dr. MOFFETT. We have prepared a report on the activities of the Great Lakes Fishery Investigations since our last meeting, which was May 1.

In order to bring all of you up to date on the life history of the sea lamprey, and to show some of the things which we have been doing, we ask that you see a movie of our activities.

Mr. BOYKIN. How long will it take?

Dr. MOFFETT. About a half-hour. I must explain that this movie is very rough. It has no sound track, no music. It will have to be explained as we go along. It was made especially for study purposes. Many of the sea lampreys are much better studied if you have it on a film record so you can run it repeatedly and observe the same action over and over.

So without further ado, I will ask our projectionists to put it on the screen and I will comment on it.

These are adult lampreys, ranging from 17 to 24 inches in length. They have spent from 12 to 17 months in the lake as parasites on the fish there. This is a view of the structure of the mouth. It is well-armed with teeth. They are able to puncture a fish in a very short time. Our records show that they will consume a fish within as little as 4 hours.

This picture illustrates a male. The digestive tract of the sea lamprey disintegrates as it matures, and ultimately disappears.

This is a stream in which the lampreys accumulate to the tune of about 24,000. We caught them coming up here for the last 3 years. They can very easily negotiate waterfalls of this type. They suck their way by means of their mouth up over the rocks.

This man pulled one off the rocks. This is a typical stream where spawning might occur. The lamprey builds a nest, which you see here. It has an elevated depression downstream. That nest is built, or that crescent is built by the lamprey moving stones from one spot to another and backing them up in that fashion.

One reason why you want to know about this nest-building activity is because the gravel has to be of a critical size. It cannot be too large so the lamprey cannot move it, and it cannot be too small because if it is, the sea lamprey's mouth cannot encompass it.

This is a picture of a pair of sea lampreys building a nest, and subsequently spawning there. They pick up rocks with their mouths and drop them on the nest and lay them down. If you will look closely you will see that very activity going on.

They usually go upstream early in the spring from about the 1st of April, depending on the season, and complete their upstream migration by June. If you will notice the little objects in the nest wiggling around, those are brook lampreys, the nonparasitic form. It takes from 3 to 7 days to build a nest. The speed of their action is related to temperature almost entirely.

After spawning the eggs hatch in from 3 to 10 days, depending upon the water temperature again, and the young that emerge from those nests have mouth parts that consist of straining mechanism, and they have no eyes. They are blind. They live throughout their 4-year larva life in mud banks similar to this one. They live in burrows in the mud and push their mouths forward, filtering the water and living off the material that they get in that fashion.

You will see the activity that they display when they reach the mud bank. You will note how they burrow into the mud bank at the bottom. They apparently feel very vulnerable unless they have something along their sides.

This man is carrying an electrical generator which we use to shock some of these larvae out of the mud bank for study. We tried this method as a means of control, but they do not all come up. Some of them just get in the mud.

That is an alternating current of about 110 volts and about 3,000 watts.

Mr. BOYKIN. Does it kill them?

Dr. MOFFETT. No, sir.

Mr. BOYKIN. Could you make it strong enough to kill them?

Dr. MOFFETT. We have made it strong enough to kill them, but it requires 100 watts per cubic inch of water. That is enough to light a light bulb, a 100-watt light bulb in each cubic inch of water in the cross section.

This is a typical stream showing the way it looks when the young move downstream. They usually go downstream late in the fall and early in the spring.

This is a screen we put in which screens all the water with a fine mesh, in order to determine how many of those changed creatures go downstream. The lamprey changes at the end of 4 years. He picks up a couple of eyes and develops this mouth full of teeth. He goes down to the lake then.

This is about their size when they get downstream, about 5½ to 6 inches in length. In the 12 months that they spend in the lake they grow from that size up to as much as 27 inches in length.

We have operated a great many aquariums in our laboratories in order to find out the physiology involved in feeding of sea lamprey on fishes, what the blood structure is, what the physiology of the entire organism is.

A great many of these trout on which the sea lamprey are attached are very pale in color. They have about 1,200,000 blood cells per cubic millimeter. At the time of death they have less than 200,000 blood corpuscles per cubic millimeter. They die probably from suffocation because there is not enough hemoglobin in the blood to carry the necessary oxygen around.

Trout suffer more readily than do many of the other fish. We have had suckers, for instance, killed in as little as 4 hours, and also we have had them carry them around for as much as 60 days. You will notice how pale that fish is. It will die in an hour or a half hour from now.

This is a curiosity. A lamprey attacked another lamprey in one of our tanks. Among the many thousands of lampreys that we have studied, coming up stream from the lakes, we have found a very, very small percentage of cannibalism, as we call it. This lamprey almost winds itself into knots trying to dislodge the other one.

The battle went on for better than a half hour without any success. You will see in the next picture what sort of a wound resulted from the lamprey, the smaller one, attacking the larger one. You will notice the fish right in with them. The lamprey doesn't pay any attention to the fish until he wants to eat. And the fish doesn't pay any attention to the lamprey.

They swim around together. There is no hot pursuit. The lamprey doesn't go along with the fish and suddenly snaps at him. When he is hungry he turns and fastens on. This indicates the scar that fish made. This is a small portable type screen, that we put in 12 streams

in upper Michigan in order to study the possibilities of mechanical types of control.

This device doesn't cost much to put in the stream, but the maintenance of it is very terrific. During periods of high water when the lamprey activity is at its greatest pitch, these have to be cleaned at least five times every 24 hours. It takes two men to do so.

This man is throwing out the fish he caught in that trap. The lampreys are put in cans for further study. The lamprey is such a slippery creature that we had to devise some means of holding onto him rather firmly. A little later you will see this man dip his hand into a pot of sand in order to properly grip the lamprey.

This little weir is taking as many as 6,000 sea lampreys out of that small stream. Last year we took better than 70,000 sea lampreys out of the waters of Lake Michigan and Lake Huron. That didn't count some 30,000 young that went downstream that we caught. All of the excessive fish that are caught in these traps are examined for lamprey scars, and registration of the location of the scars is made.

There seems to be a different rate of mortality depending on where the lamprey hits the fish. If the lamprey hits the fish on its favored spot, usually under the chin or over an eye, death ensues very rapidly. If they attach to the side of the body and are not too interested in feeding, they will stay there for hours and hours.

This picture is taken at a time when the stream is low. These lampreys for the most part have been measured and sexed. That may sound like a lot of scientific dribble, but in Lake Huron we found the sea lamprey, as it has leveled off in numbers, to become smaller in length and weight. If we are going to do a job with this half-inch screen we would have to keep in very close touch with the relative size of the lamprey so that we could reduce the mesh if the lamprey got small enough to go through.

Incidentally, since 1947 the lampreys have cut down 1 inch in average lengths. If they cut down another half-inch all of these mechanical-type weirs are going to have to be equipped with a quarter-inch weir cloth, and that will increase our labor costs by about four times.

We have done considerable work tagging these beasts to see where they go in the Lakes. They are great loaders. We tag them in one stream which we block their access to, and they turn up in 12 others, some of them as much as 150 miles away from the tagging site. We suspect that they were transported there on the bottom of ships. You will notice how small that intestine is in that lamprey and larger in the ones we saw previously. The digestive system is very similar to that found in the Pacific salmon. That is our major evidence for the fact that lampreys die after spawning. We have never taken one in the lake 2 years old, and we are doubtful that the sea lamprey ever get back in shape after spawning.

This spans a 90-foot stream, consisting of half-inch bars, or bars spaced at half-inch intervals, and three traps. It has taken as many as 24,000 or 25,000 sea lampreys in a single season. But it takes four men to run that one weir, and in periods of high water we have to have two more men in order that the weir is not washed downstream. That weir was built at a cost of $13,000. We have spent a good $8,000 in maintaining it.

It is obviously a way to control sea lampreys, but not an economical way. This is illustrative of several weirs that we have in the stream

leading to Lake Michigan. There are various setting and various types used. I helped put in one, this one. The day we put it in, in 1 hour of work, I wound up with ice about a quarter of an inch thick on one side of my face, and so did everybody else, because we had a northeaster blowing on Lake Huron, and they are really tough.

This structure is in Wisconsin. This is a rear view of the weir through which all the water dropped in order to give us a complete story of the downstream migration of the sea lamprey going out to sea. This is a barrier dam, as we call it, installed by the State of Michigan. It consists of a lip of steel fastened to a straight vertical dam. The sea lampreys go up under the lip. That costs about $2,000 to install. This is a view of another weir which consists of essentially a row of electrodes which the man is holding up, as one pole, and a submerged electrode about 4 feet downstream, the other pole. The electricity given to that stream is generated on an opposite bank. It is a set of complicated tubes and condensers and sends out about 800 volts. This is one we developed with an electric company to stop sea lampreys. This consists mainly of three rows of aluminum tubing into which we introduce straight line current. We can use it right off the power pole. This generator puts out 25 kilowatts. At the time we started this experiment we didn't know how much juice we were going to have to have. So we powered heavily.

We found that we could stop sea lampreys in that stream, a 90-foot stream, with less than 2½ kilowatts. This is a bypass trap into which the game fish can go. That is the end of the movie, and I thank you for letting me bring you up to where we left you last year.

Mr. BOYKIN. That is very, very interesting, Doctor, how many did you kill, since you have been up here?

Dr. MOFFETT. This year we got close to 70,000; better than 70,000. That was last spring. It was going on while we were having the hearing.

Mr. BOYKIN. What do you do with the meat?

Dr. MOFFETT. After we get the biological information we just bury it. A Canadian, a Latvian by extraction, claims to have found a method of making them palatable. He has been in operation 1 year. He took a great many that Canada caught and apparently sold them. The test of his enterprise will depend on the repeat orders. Frankly, they do not taste very good to me.

Mr. BOYKIN. About how many pounds of fish would that 70,000 make? How much do they weigh?

Dr. MOFFETT. They will weigh about four to the pound. That would be about 15,000 or 17,000 pounds.

Mr. BOYKIN. Can you make fertilizer out of them?

Dr. MOFFETT. You could. But they are not abundant enough in any one place.

Mr. BOYKIN. Did I understand you to say that one of those eels had 67,000 fish eggs in it?

Dr. MOFFETT. That is the average number of eggs.

Mr. BOYKIN. How many did you catch?

Dr. MOFFETT. 70,000.

Mr. BOYKIN. Just off the one stream?

Dr. MOFFETT. Yes; we don't make any pretense of saying that we are controlling lampreys by catching those 70,000.

Mr. BOYKIN. Have you killed many more?

Dr. MOFFETT. We have killed a lot of downstream migrants to the tune of 40,000 or 50,000.

Mr. BOYKIN. I have on my place, a hunting preserve, a large lake. People got old telephones, and put batteries on them, dropped wires down, and they catch fish. We have catfish from 2 and 3 pounds up to a hundred pounds. They drop the batteries and catch them by the hundreds. All they do is ring a bell.

Dr. MOFFETT. We have tried that.

Mr. BOYKIN. I wonder if we couldn't get a battery that would kill every one of them.

Dr. MOFFETT. We think we have a gadget now.

Mr. BOYKIN. It would kill some other fish, but they will kill all the fish themselves, if we don't kill them first.

Dr. MOFFETT. You will notice that was put in on a diagonal. Many of the game fish come upstream, feel the pattern, and as soon as they hit the shielded area, they are in the trap. They can be released upstream without any difficulty.

Mr. BOYKIN. Does the sea lamprey have any scales on it?

Dr. MOFFETT. No, sir.

Mr. BOYKIN. This electrical instrument won't kill the fish with the scales on it, and you kill just the sea lampreys and not the other fish.

Dr. MOFFETT. We can do a pretty good job of killing suckers. They do just what the lampreys do. They will not orient at all.

Mr. WEICHEL. Do the suckers suck on fish?

Dr. MOFFETT. No, sir. We call them suckers because they have a proboscis-like mouth because they raise algae off the bottom.

Mr. WEICHEL. Have you a sufficient solution to say that this is a practical solution.

Dr. MOFFETT. Our program for the future is intended to prove that.

Mr. WEICHEL. How much money was appropriated and spent in 1949?

Dr. MOFFETT. The original authorization to the Service in 1947 was $20,000. In 1948 it was $20,000. In 1949, in October 1949—do you want exact figures?

Mr. WEICHEL. Approximately.

Dr. MOFFETT. About $279,000.

Mr. WEICHEL. In 1949?

Dr. MOFFETT. Yes, sir.

Mr. WEICHEL. How much in 1950?

Dr. MOFFETT. That was for the fiscal year 1950.

Mr. WEICHEL. What in 1949, fiscal year, was that the first?

Dr. MOFFETT. In fiscal 1949 we had $20,000. In fiscal 1950 we had $279,000.

Mr. WEICHEL. And fiscal 1951 you had how much?

Dr. MOFFETT. I beg your pardon. That was $259,000.

Mr. WEICHEL. That is $300,000. How much did you get for fiscal 1951?

Dr. MOFFETT. $198,000.

Mr. WEICHEL. That is nearly $500,000. How much for fiscal year 1952?

Dr. MOFFETT. We had a—that is the one we are in now—we had an original appropriation of $188,000.

Mr. WEICHEL. You had $600,000 pending for fiscal 1951.

Dr. MOFFETT. As a result of the committee's action last May we were given a supplemental $150,000.

Mr. WEICHEL. For the fiscal year ending 1951 you had approximately $600,000 that has been spent?

Dr. MOFFETT. Yes, sir.

Mr. WEICHEL. For the fiscal year ending 1952, another $198,000 on top of that. How much for fiscal 1952?

Dr. MOFFETT. In fiscal 1952 we were allotted $188,000, and then as a result of the increased authorization in supplemental appropriation we received $150,000 additional.

Mr. WEICHEL. That is $330,000 for the fiscal 1952, and you already spent $500,000.

Dr. MOFFETT. That is right.

Mr. WEICHEL. You haven't gotten the fiscal 1952 funds spent yet because you just got them about a month ago.

Dr. MOFFETT. That is right, sir.

Mr. WEICHEL. So that is $300,000 plus $500,000 or $800,000. How many more thousands do you want for the fiscal year that you are in?

Dr. MOFFETT. Our request is for an authorization to ask Congress for $466,000.

Mr. WEICHEL. That is nearly $1,300,000 that Fish and Wildlife wants on this, and have already had $800,000, and the States have spent $20,000.

Dr. MOFFETT. That isn't quite right, sir. I prepared in the past a breakdown of State participation and Provincial participation for the Bureau of the Budget. They have asked the same questions that you are asking. It is very long. I am not inclined to read it to the committee, but I certainly would offer it if you gentleman want to read it.

Mr. BOYKIN. We would like to have you put it in the record, without objection.

(The matter referred to follows:)

A REPORT ON THE STATUS OF STATE AND PROVINCIAL COOPERATION IN STUDIES AND CONTROL OF THE SEA LAMPREY IN THE GREAT LAKES

Sea lamprey attacks on important commercial fish species in the Great Lakes above Niagara Falls began to cause great concern in the Lake States of the United States and the Province of Ontario, Canada, at about the same time as World War II began. Catches of lake trout in Lake Huron waters began to decline seriously in 1940. In subsequent years the decline accelerated until by 1944 less than one-third of the usual annual poundage was being landed. Complaints began coming in from fishermen especially those operating in Lake Huron waters, but the State of Michigan and the Province of Ontario were not not in a position to investigate or to attempt to retard the decline seriously because of wartime shortages of men, materials, and equipment. Fishermen's reports unanimously attributed the collapse of the lake trout fishery in Lake Huron to the depredations of sea lampreys. But, it was not until the lake trout in Lake Michigan began to decline in abundance, about 1945, that any widespread alarm was voiced.

Certain surveys and observations were begun by the State of Michigan and the United States Fish and Wildlife Service as early as 1938 but these studies were on a very limited scale. Results of these and subsequent observations established definitely that the sea lamprey was the major contributing factor in the collapse of the Lake Huron and Lake Michigan lake trout fisheries.

The effects of the collapse of the lake trout fisheries on the fishing industry of Michigan, Wisconsin, Illinois, and Indiana were so drastic that several municipalities, counties, and fishermen's organizations pressed State legislatures and congressional delegations for action. Losses of income to the fisher-

men amounted to about $3,500,000 annually. Numerous minor fisheries that were carried on incidentally to the lake trout fishery were in danger of abandonment. Local economic depressions resulted. Many foreclosures on boats, nets, and equipment were necessary. Everyone appeared willing to do something about the sea lamprey but no one knew just what should be done. Many fishermen moved into other fisheries, greatly increased the pressure on certain fish stocks, and seriously overcrowded several areas where fishing for species other than lake trout was good. Lake Superior trout fisheries were overexploited because of heavy market demands until they too are now in a precarious condition. The Lake Superior lake trout fishery would have ceased or certainly become drastically reduced had market prices remained as they were before the loss of Lake Michigan and Lake Huron fisheries. Increasing sea lamprey populations in Lake Superior are threatening seriously to repeat the history of their predations in the other lakes. Their influence on Superior lake trout stocks is becoming more and more evident with each passing season.

Out of this chaotic confusion there emerged a plan for action which was originated largely by the United States Fish and Wildlife Service. A meeting of representatives of interested State conservation departments and the Fish and Wildlife Service was called in Ann Arbor, Mich., for November 14–15, 1946. Participants organized a program of study on the sea lamprey and established a technical committee to coordinate individual efforts. This committee was called the Great Lakes Sea Lamprey Committee and consisted of one representative from each of the Great Lakes States, the Province of Ontario, and the Fish and Wildlife Service. The Service representative is chairman. The organization is still in existence, holds at least one meeting annually and attempts to coordinate all technical programs of study directed at the sea-lamprey problem. At its annual meeting, the committee hears, and assembles for later reference, reports on progress made by each participating governmental unit. It reviews programs proposed for the coming year and suggests changes, consolidations and new studies. This committee has no powers. Its members cannot obligate their respective agencies; neither can they dictate the course of further work, cooperative action or the magnitude of effort expended. Despite these emasculating limitations the committee does serve to maintain contact and to distribute current information for the good of the member agencies.

It is largely from the annual reports of this committee that the following digests of individual State and Provincial efforts have been made. These digests involve work done since 1945.

MICHIGAN

This State is more concerned with the sea-lamprey problem than any of the others and consequently, it has done much to advance our present knowledge of the sea lamprey in Great Lakes waters.

1946:

1. Initiated sea-lamprey life-history study by (*a*) establishing and outfitting a predoctoral fellowship at the University of Michigan, (*b*) having district fishery biologists and wardens make spawning observations, and (*c*) operating a temporary two-way weir and trap in Ocqueoc River.
2. Started surveys of Michigan's lower peninsula streams to determine sea-lamprey spawning-run distribution. Wardens and district fishery biologists did this work in connection with other duties. Reported 68 streams in which such runs were definitely established.
3. Urged sportsmen, commercial fishermen, and citizens to report presence of lampreys and losses incurred due to lamprey attacks on fishes.

1947:

1. Continued support of sea-lamprey life-history study.
2. Continued stream survey and verified: (*a*) Sea-lamprey runs in a total of 83 streams (not in addition to 1946 total) and (*b*) established the presence of sea-lamprey populations in Burt, Mullet, Charlevoix, and Pentwater Lakes (large inland waters).
3. Constructed an inclined plane screen for capture of downstream migrating young sea lampreys on Carp Lake River.
4. Constructed a temporary weir and trap in Carp Creek which caught 1,617 adult lamprey.
5. Found electrical shockers of no use in the control of larval lampreys in the silt beds of streams.
6. Operated temporary Ocqueoc River weir, estimated 8,000 to 9000 lampreys in run.

1948:
1. Continued support of sea-lamprey life-history study.
2. Continued stream surveys and verified: (*a*) Sea-lamprey runs in 108 streams and (*b*) sea-lamprey establishment in Lake Superior by finding runs in three Lake Superior streams.
3. Operated Carp Creek weir and took 2,936 lampreys.
4. Established that dredging and poisoning with rotenone of sea lamprey larval beds were not good methods of control.
5. Operated Carp Lake River inclined screen trap intermittently.

1949:
1. Continued and practically concluded life-history studies. At year's end doctoral candidate had finished his thesis.
2. Operated Carp Creek weir—took, 2,763 adult lampreys.
3. Operated permanent Ocqueoc River weir built by Fish and Wildlife Service—took 24,643 adult lampreys.
4. Operated Carp Lake River inclined plane screen.

1950:
1. Cooperated in the operation of Ocqueoc River weir.
2. Cooperated in the operation of Carp Lake River inclined plane screen which had been rebuilt and strengthened with Service funds.
3. Constructed and operated a barrier dam-type lamprey blocking device in Black River.

Since 1945, Michigan has budgeted the sum of $10,000 annually for sea-lamprey work. This amount is a minimum, since the time of district fishery biologists, wardens, administrators, and others involved in activities described above was not accountable. It is estimated that $15,000 annually might be added to the expenditures for lamprey work done by the State of Michigan.

WISCONSIN

The shore line of this State bordering on the Great Lakes is not as extensive as that of Michigan. However, the commercial fishery of Wisconsin is very important in the economy of certain portions of the State. Wisconsin's contribution to study of the sea-lamprey problem has not been as extensive as that of Michigan mainly because of a desire to avoid duplication of work.

1946:
1. Made surveys of commercial catches for damage by sea lamprey.
2. Made cursory surveys of Wisconsin streams to locate spawning runs of sea lampreys. Reported runs of sea lampreys in four streams tributary to Lake Michigan.

1947:
1. Survey streams tributary to Green Bay and Lake Michigan.
2. Constructed and operated a trapping weir on Hibbards Creek—took 596 adult lampreys.
3. Sent questionnaires to commercial fishermen to determine rate of scarring on lake trout. Fishermen report 40 percent scarred.
4. Inspected commercial catches and established a 45-percent scarring incidence.

1948:
1. Reported sea lamprey in Lake Superior waters of Wisconsin.
2. Operated Hibbards Creek weir and trap—took 989 lampreys.
3. Found 61 percent of lake trout taken off Milwaukee scarred.
4. Trapped some adult lampreys in Menominee River but because this is boundary water, they recommended Michigan take over trapping since fish ladder over dam is on Michigan side.
5. Found many dead and dying lake trout taken in fishermen's nets. All of these were marked by lampreys.

1949:
1. Operated lamprey traps in four streams intermittently—took 2,754 lampreys.
2. Found eight streams in which traps should be operated.

1950:
1. Operated six lamprey weirs and traps furnished by the Fish and Wildlife Service—took 16,410 adult lampreys.
2. Casual observations revealed no spawning runs in Lake Superior streams.

Wisconsin has expended about $5,000 annually for direct sea-lamprey work. Many indirect contributions of manpower and time by permanent employees are

not considered in their cost accounting. It is estimated that Wisconsin spends indirectly an additional $10,000 in sea-lamprey work.

MINNESOTA

This State has a limited shore line on the Great Lakes and is not especially concerned with sea-lamprey predation at the present time. The so-called north shore of Minnesota along Lake Superior has not shown serious effects of sea-lamprey populations. Minnesota is interested in the problem and maintains vigilance over her Lake Superior waters in anticipation of worsening conditions.

1946: No program—no problem as yet.
1947:
1. Check of commercial lake trout fishery by questionnaire showed slightly less than 8 percent of trout scarred.
2. Surveys of streams revealed no spawning runs.

1948:
1. Check of commercial lake trout landings showed a low percentage of scarring.
2. North shore streams checked periodically.

1949:
1949: 1. Continued checking lake trout catches—13 marked fish found in 14,919-pound sample.

1950:
1. Surveys of streams revealed that of 30 streams, only 4 did not have natural barriers in the lower 1.5 miles of their courses. Only four streams had any larval habitat.
2. Twenty-two of 1,309 lake trout checked were scarred.
3. Traps operated in eight streams took no adult lampreys. Three adult lampreys were taken from the Sucker River with a shocker.

Minnesota does not budget a special sum for sea-lamprey studies. It is estimated that their expenditures for this work will average $1,000 annually.

ILLINOIS

The Illinois shore line on Lake Michigan is quite limited in extent. Nevertheless, several active fishery establishments have operated there for many years. The State's interest in sea-lamprey predation on Great Lakes fishes is restricted and no special effort has been put into any studies of this parasite. Concern has been voiced over the possibility of introductions of sea lampreys into the Mississippi drainage through the maze of canals between Lake Michigan and the Illinois River.

1946: No program—offered cooperation.
1947: No program.
1948: No program.
1949:
1. Legislature appropriated $10,000 to investigate (by legislators) the sea-lamprey problem. A series of meetings held in Illinois, Wisconsin, and Michigan.
2. Test netting on known lake trout spawning grounds took six lake trout, three of which bore lamprey scars. Fifteen thousand feet of gill net were set at a depth of 36 fathoms.

1950:
1. No sea lampreys found in Mississippi drainage.
2. Thirty-three lake trout taken in 23,400 feet of gill net set as test.

INDIANA

The shore line of Lake Michigan bounding Indiana is very short. Interests of this State in Great Lake fisheries are not great, however, Indiana has always been willing to cooperate to further the welfare of fisheries in Lake Michigan.

1946: No program.
1947: Inspected Trail Creek, a tributary to Lake Michigan but found no sea lampreys.
1948: No program.
1949: Sea lampreys found in Trail Creek and Little Calumet River. Danger of dispersal to Mississippi drainage through the Calumet River.
1950: Operated a lamprey weir in Trail Creek (material furnished by the Fish and Wildlife Service). Twenty-three days of operation yielded 896 adult sea lampreys. Weir washed out frequently.

OHIO

Ohio has jurisdiction over the major portion of the United States shore line of Lake Erie. Ohio fisheries are impressive in their volume of production and their importance in the economy of many communities along the lake. Although the sea lamprey was found first in Lake Erie, it never became a serious menace to Ohio's fisheries because Lake Erie was not well adapted to its spread. This State has always shown a healthy interest in the sea-lamprey problem.

1. Few sea lampreys seen in Lake Erie.
2. Listed factors responsible for the lack of heavy populations: (*a*) Pollution, (*b*) turbidity in streams, and (*c*) high dams near the mouths of most important streams.

1947:

1. Continued field study to determine status of sea lampreys in Lake Erie.
2. Undertook a study of larval lampreys to find morphological characters useful in separating the young of various lamprey species.
3. No spawning runs found in Ohio streams.
4. Offered a reward of $1 for each sea lamprey turned in to the Franz T. Stone laboratory. One lamprey was received.

1948: No report.
1949: No increase in predation or presence of sea lampreys.
1950: No increase in predation or presence of sea lampreys.

PENNSYLVANIA

The borders of this State involve only a small segment of Lake Erie shore line. A rather vigorous fishery is located at Erie, Pa. It has not been more seriously affected by sea-lamprey predation than any of the other producers on Lake Erie. Pennsylvania is interested in the sea-lamprey problem and has done some work to learn the extent of lamprey populations in its waters.

1946: No damage to fishery—no concern.
1947: No damage to fishery—no concern.
1948: No damage to fishery—no concern.
1949: No damage to fishery—no concern.
1950:

1. Surveys were made of the commercial fishery and of streams where sea lampreys might spawn.
2. One control weir was built but it washed out twice in 12 days of operation. Only two sea lampreys were taken during the 12-day period. In all, 15 sea lampreys were found in streams of the State.

NEW YORK

This State has very little shore line on Lake Erie. Its concern in the sea-lamprey problem has been general. It has not instituted a program of study or survey although sea lampreys have been in the Finger Lakes and Lake Ontario for many years.

ONTARIO

This Province occupies the entire Canadian shore line of the Great Lakes. Their problem of fishery maintenance in the face of sea-lamprey predation is especially accentuated because of a greater dependence of provincial economy on fisheries than is found in any of the States and because of the wide expanse of shore line under one jurisdiction. The fact that the problem concerns only one Province makes it somewhat difficult for the Canadian Federal Government to step in and assist. Ontario has put forth considerable effort toward a solution to the sea-lamprey problem but they feel the problem should be worked out between the two countries since it is one of mutual concern. The work of this Province on sea-lamprey since 1945 is summarized below.

1946:

1. Circulated questionnaires to fishermen for information on (*a*) damage to fish, (*b*) losses in income and (*c*) reductions in catch per unit of effort.
2. Constructed and operated weirs and traps of various types in six Lake Huron streams. Took 11,416 lampreys but only a fraction of the runs into the streams weired.
3. Operated hoop nets experimentally to determine if they were satisfactory control devices. They took only 140 sea-lampreys from 6 streams.
4. Had the entire Provincial field staff looking at streams for the presence of lamprey spawning grounds.

1947:
1. Obtained materials for a life-history study from runs in Little Thesalon River.
2. Operated 9 weirs—caught 6,245 lampreys.
3. Tried several kinds of weirs—no absolute control with any of them. Floods and locations prohibited continuous count.

1948: 1. Operated five traps in five streams of Lake Huron. Trapped 6,990 sea lampreys.
2. Surveys of provincial streams were continued.

1949: 1. Five weirs were operated. Some of them were ineffective because of wash-outs. Took 7,459 lampreys.
2. Sea lampreys found in Lake Superior 80 miles north of Sault Ste. Marie.
3. Volunteer operation of weirs proved unsuccessful.
4. 1948 statistics on scarring of lake trout in Lake Superior showed 6 percent of all trout were affected. Individual lots in February showed scarring incidence as high as 23 percent.
5. In 1949, 42 percent of all lake trout taken in April were scarred. The average scarring incidence for the year was 13 percent.

1950: 1. Surveys in Lake Ontario proved the lamprey population in Bay of Quinte extensive. Runs into Trent River were very heavy.
2. Incomplete surveys in Lake Huron revealed established sea lamprey spawning runs as follows:
   (*a*) Georgian Bay, 1 stream;
   (*b*) Manitoulin Island, 3 streams;
   (*c*) North Channel, 22 streams;
   (*d*) St. Joseph's Island, 7 streams.
3. Examination of 12 Lake Superior streams revealed runs in nine of them. Established runs are in the Thunder Bay district of Lake Superior.
4. Scarring of trout in Lake Superior is on the increase.
5. Weirs in five streams of Lake Huron took 16,440 sea lampreys.

Direct costs of the lamprey work done in the Province of Ontario have amounted to about $10,000 annually. However, at times, the entire organization was engaged in making surveys, checking trout for scarring and making other observations. Some of the regular staff was engaged in weir construction and operation. It is estimated that Ontario's indirect expenditures for sea lamprey study will approximate conservatively $20,000 annually. Their total expenditure will approach $30,000 per year.

The combined efforts of the various States and the Province of Ontario in seeking a solution to the sea-lamprey problem bulk fairly large when all factors involved are considered. Each governmental unit has a fairly large organization concerned with fish and game matters. Concentration of these organizations on a single problem along with other regular business does not require special budgets, staff enlargements or changes. The effort expended is, however, comparatively great. The man-days applied to the problem in question are difficult if not impossible to total or to figure into a strict cost accounting.

Equipment used in construction and in surveys is already property of the organization and does not represent a single-purpose procurement. Automobiles, trucks, cement mixers, and other major and minor items are used on many jobs other than sea-lamprey weirs and for the most part, are charged against regular activities.

A recapitulation of the efforts of the States and Ontario in terms of annual expenditures is difficult to make. Especially is this so when such expenditures must be compared with annual expenditures of the United States Government made by congressional appropriation for a specific purpose. However, it does not appear unreasonable to estimate the annual cost of the combined State and provincial efforts toward solution of the sea-lamprey problem at $75,000–$100,000.

One of the major influences which has deterred individual States and the Province of Ontario from making more strenuous efforts toward solution of the sea-lamprey problem is the truly international character of the Great Lakes, their sea-lamprey populations and their fish populations. Difficulties encountered by individual State or provincial governments in studying the Great Lakes as ecological units are obvious and need not be explained further. Even the two Federal Governments involved have been handicapped by the fact that no enabling agreements have been reached whereby unrestricted study or

regulation of the lakes as units could be accomplished. Interstate compacts need the approval of the Federal Government to become effective and compacts between States and the Provinces of Canada have no legal status.

The responsibility of the Government of the United States in solving the sea-lamprey problem seems well established when the interstate and international aspects of the question are considered. Freedom of action over the entire expanse of the Lakes, or at least over the United States waters, is a specific requirement if the fishery problems are to be adequately circumscribed. Precedents are common in support of this designation of responsibility. Reference is made to the confusion of studies and regulations which preceded establishment of the interstate and international character of migratory wildfowl and certain very important marine fisheries. It is presumed that the uncertain status of the Great Lakes treaty awaiting United States Senate ratification may have deterred more concerted effort on the part of Canada. The desire to do nothing which could be construed as grounds for abandonment of this treaty may have influenced the decision of the Canadian Federal Government to refrain from work on the sea-lamprey problem.

Another very real problem affecting State efforts in finding and applying methods of sea-lamprey control and rehabilitation of the Great Lakes fisheries lies in the fact that all of the States are organized, and for the most part financed, to serve the needs of sports fishermen in inland waters. Commercial fisheries contribute a very small proportion of the States total revenue for fish and game departments, and there is a justifiable hesitancy to divert large sums toward their welfare when the possibility of excessive criticism from sportsmen might result. This attitude may be short-sighted and eventually to the detriment of the sports fisherman but, nevertheless, it certainly influences policy. The State conservation departments generally consider the Great Lakes fisheries as someone else's responsibility. There is no specific definition of where this responsibility lies, but the great number of abortive attempts at formation of compacts for study and regulation of these fisheries indicate a general disinterest. There exists the impression that some States would be relieved considerably if administration of the Great Lakes fisheries were a Federal responsibility. Practically all other uses of the Lakes are administered and controlled by the Federal Government.

Aside from all of the arguments and evaluations, the restoration and perpetuation of this abundant supply of protein food yielded each year by the Great Lakes should be of utmost importance. Regardless of degrees of responsibility, equitable partition of costs, and problems in cooperation, the fish production of these waters must be saved for the good of the Nation. This production should not be allowed to collapse while the problem of who is going to perpetuate it is laboriously and slowly brought either to hapless confusion or full clarity. There is nothing unique in the effort of the Federal Government to solve the sea-lamprey problem and restore the Great Lakes fisheries. Federal contributions to the welfare and benefit of agriculture, to the aid of States in game and fish restoration, and to the aid of many other causes of interest and worth in the common welfare clearly establish policy and practice.

Mr. WEICHEL. Have you also prepared with reference to the amount of money that the Appropriations Committees have provided since 1926, how much money is spent with all salaries and everything else, dealing with the scarcity of fish since 1926? I think we ought to have those figures too, to see how much has been put in, supposedly, to study the Great Lakes fish industry since 1926. We want those figures.

Dr. MOFFETT. I think our Washington office would be in a better position to give you those.

Mr. WEICHEL. You are not in the Washington office?

Dr. MOFFETT. No, sir. But I can certainly get them for you.

Mr. WEICHEL. Who prepared this budget for this year?

Dr. MOFFETT. I did, or our staff did.

Mr. WEICHEL. Here in Washington?

Dr. MOFFETT. No, sir. In Ann Arbor.

Mr. WEICHEL. Where did you get the figures?

Dr. MOFFETT. You mean what we had spent?

Mr. WEICHEL. You just said that you have data for the Bureau of the Budget. Are you appearing before the Budget Commission?

Dr. MOFFETT. No, sir.

Mr. WEICHEL. Who did you prepare this for?

Dr. MOFFETT. The Bureau of the Budget, for my Service to give to the Bureau of the Budget.

Mr. WEICHEL. For the Service to give?

Dr. MOFFETT. Yes.

Mr. WEICHEL. That was at the request of the head of the Service?

Dr. MOFFETT. That was his request to me, yes, but he had been requested in turn by the Bureau of the Budget for the justification.

Mr. WEICHEL. As to how much has already gone into this since 1928, as to how much was spent for personnel and everything else since 1926 on the problem with reference to the study and research on depletion of fish—this is just one phase of it—how much was spent on top of the $1,300,000 that you have had in the last few years. I would like to have those figures.

Dr. MOFFETT. I am not prepared to give you those figures.

Mr. WEICHEL. You do not have them with you, I know that.

Dr. MOFFETT. We will get them for you.

(The information referred to follows:)

Expenditures, Great Lakes fishery investigations

	Salaries	Expenses	Total		Salaries	Expenses	Total
Fiscal year—				Fiscal year—Con.			
1926	$2,400	$750	$3,150	1940	$14,340	$2,379	$16,719
1927	2,640	7,500	10,140	1941	16,340	7,010	23,350
1928	6,180	9,000	15,180	1942	13,440	5,310	18,750
1929	7,340	13,656	20,996	1943	12,520	1,350	13,870
1930	7,500	10,890	18,390	1944	12,240	2,100	14,340
1931	8,725	15,000	23,725	1945	15,190	1,300	16,490
1932	11,140	15,280	26,420	1946	14,435	850	15,285
1933	12,000	2,950	14,950	1947	19,798	1,000	20,798
1934	10,460	550	11,010	1948	20,508	18,358	38,866
1935	12,357	1,235	13,592	1949	26,561	5,020	31,581
1936	12,840	1,585	14,425	1950	61,425	225,129	286,554
1937	11,050	1,500	12,550	1951	129,047	73,096	202,143
1938	12,300	1,500	13,800	1952 [1]	145,750	197,911	343,661
1939	14,269	1,650	15,919				

[1] Estimated.

Mr. BOYKIN. Mr. Allen?

Mr. ALLEN. Dr. Moffett, is it your best guess that this four-hundred-thousand-odd dollars will wind up the proof of this present endeavor?

Dr. MOFFETT. I am very confident of it.

Mr. WEICHEL. How was this $1,000,000 spent? How much of it was spent for personnel? What was it spent for?

Dr. MOFFETT. The hearings last year carried it up to the current fiscal year?

Mr. WEICHEL. How much was spent up to last year when you testified?

Dr. MOFFETT. I can't recall. I don't believe I brought a copy——

Mr. BENNETT. What do you think the $400,000 is going to be used for in the future?

Dr. MOFFETT. I want to explain that to you in detail.

Mr. WEICHEL. I would like to know what you did with those figures, with that money, besides the other figures I asked for, which you have not included.

Dr. MOFFETT. I think the hearings of last year will explain most of the expenditures up to and including fiscal 1951.

Mr. WEICHEL. Don't you remember anything about it without my reading it?

Dr. MOFFETT. I couldn't give you all those breakdowns.

Mr. WEICHEL. I am talking of approximate figures. In other words you spend $600,000 up to last year in less than 2 years, besides the other moneys which you haven't data on. What was it spent for? What was the bulk of the sum spent for. How much was spent for personnel?

Dr. MOFFETT. In the 1950 fiscal year?

Mr. WEICHEL. Of the $600,000 that was spent up to that time?

Dr. MOFFETT. I would have to go to work and figure that out and do it on a lump-sum basis.

Mr. WEICHEL. What was spent for material? How about the purchases of material and physical goods?

Dr. MOFFETT. I will give it to you in general totals. Fiscal year 1950, we spent $36,000 setting up the organization in Ann Arbor.

Mr. WEICHEL. $36,000 to set up the organization. What does that mean? Desks and office equipment?

Dr. MOFFETT. As a matter of fact we didn't have a chick, nor a child, nor a place to live in. Salaries for Ann Arbor personnel, $28,000. Most of that is clerical.

Mr. WEICHEL. Did the State of Michigan offer a place for you to sit down?

Dr. MOFFETT. The University of Michigan furnishes us quarters.

Mr. WEICHEL. You said $36,000 to set it up.

Dr. MOFFETT. I have to buy automobiles, typewriters, various and sundry other things when you start from scratch.

Mr. WEICHEL. Was that the first year?

Dr. MOFFETT. That is the first year.

Mr. WEICHEL. That is the first year that you started to spend $800,000. You spent $36,000 to set it up for automobiles, typewriters, and the rent was free.

Dr. MOFFETT. The rent was not quite free. It ran about $200 a month, but that is for services, light, power, and heat. The building is not figured in.

Mr. WEICHEL. Where do they provide you a place in Ann Arbor?

Dr. MOFFETT. They dumped about 12 nurses out so we could have a house to live in.

Mr. WEICHEL. That is $36,000. Where is the rest of it?

Dr. MOFFETT. $28,000 for salaries of Ann Arbor office personnel, $56,800 for the establishment and for salaries at our Hammond Bay laboratory.

Mr. WEICHEL. $56,000 for salaries at Hammond Bay?

Dr. MOFFETT. Salaries and establishment of the Hammond Bay laboratory.

Mr. WEICHEL. What kind of an establishment is that?

Dr. MOFFETT. Hammond Bay Laboratory is a Coast Guard station which was given to the Service or loaned to the Service so that we could set up a place where we could experiment with the sea lamprey.

Mr. WEICHEL. Where is that?

Dr. MOFFETT. It is about 12 miles north of Roger City, on Lake Huron.

Mr. WEICHEL. You did not have to pay rent for that?

Mr. MOFFETT. No.

Mr. WEICHEL. $50,000 for the set-up. What is that?

Dr. MOFFETT. We had to equip the place from the floor up. That involved stoves, aquaria, pumps, compressors, electrical gadgets, wiring, and also involved the installation of 12 temporary weirs in streams near there, it involved materials for 8 blocking weirs of the same type in Wisconsin, and for one stream on Lake Superior. Our idea in doing that was to cover a rather large section of shoreline on Lake Huron completely, to see if it could be done.

Mr. WEICHEL. That is about $100,000.

Dr. MOFFETT. No, sir; that is $56,000.

Mr. WEICHEL. I mean added to what you already talked about, that is $100,000.

Dr. MOFFETT. It will total $259,000.

Mr. WEICHEL. What is the other $100,000?

Dr. MOFFETT. We established a field laboratory at Sturgeon Bay, Wis., for the purpose of investigating sea lampreys and fish of that area. That cost us $8,600. We established a field laboratory at Marquette, Mich., for the study of learning the condition of the only remaining stock of lake trout and to gain more and more information on the life history of the lake trout. That cost us $13,651. We bought a Berkey electric screen from the Electric Fish Screen Co., in California that cost us $6,100. We built and equipped a research vessel for $76,000.

Mr. WEICHEL. $76,000 for what?

Dr. MOFFETT. A vessel.

Mr. WEICHEL. How big?

Dr. MOFFETT. Sixty-foot steel hull, 16 foot beam vessel, with which we intended to study the——

Mr. WEICHEL. Is that a new vessel for $76,000?

Dr. MOFFETT. That was a new vessel.

Mr. WEICHEL. Sixty-some feet long for $76,000?

Dr. MOFFETT. Yes. We let a contract with a firm of research engineers, electrical engineers, to the tune of $33,000, roughly, to furnish us with engineering talent in the electrical field so that we could, without trying to make over biologists—and Lord knows they have been made over into everything—without trying to make over a biologist—get together in a team effort to apply biology and the know-how of the electrical engineer to the problem at hand.

Mr. WEICHEL. Who are the personnel for the $33,000? Where are they from?

Dr. MOFFETT. That is a firm of electrical engineers in Chicago—Cook Electric Co.

Mr. WEICHEL. Couldn't you have gotten that kind of a price from the Ann Arbor School of Engineering, for less than that?

Dr. MOFFETT. We got an offer to do the same work from the Engineering Research Institute, at the University of Michigan, and they wanted some—I have forgotten the exact sum—$48,000 to $58,000 for the first year.

Mr. WEICHEL. Is that a commercial concern?

Dr. MOFFETT. No, sir. It is a State institution.

Mr. WEICHEL. The State of Michigan itself wanted that much money although they were going to get the benefit out of it?

Dr. MOFFETT. The university did. We put this out on bids. We had a company in California, the American Institute of Radiation, submit a proposal; Cook Research Laboratories submitted one; University of Michigan submitted one, and several refused to submit bids. The Cook contract was cheaper by about $15,000.

Mr. BENNETT. What kind of a contract was that?

Mr. MOFFETT. We put up a proposal that we wanted certain pieces of work done, consisting of two phases, one of development and trial of the means of killing downstream migrating sea lampreys. The second phase was the establishment and trial of a means for killing upstream migrating sea lampreys. That involved the use of all engineering talent that we could possibly recruit in the field of electronics, in the field of mechanical engineering, and in the fields connected with ordinary electricity, and we were talking about sound and supersonics and several other approaches.

Mr. BENNETT. Do you think that is a more economical thing than to have the Government itself, through its Government officials, attempt to do it.

Dr. MOFFETT. I know that agencies like the Navy and Army have found it more economical. Engineers are much more expensive than biologists. That firm furnished us with the talent at, I would say, a very reasonable figure.

Mr. BENNETT. You feel it was an economical thing for the Government to do in entering into a contract for this research?

Dr. MOFFETT. Yes, sir.

Mr. WEICHEL. Was this for advice?

Dr. MOFFETT. And actual operation and furnishing materials.

Mr. WEICHEL. Building the apparatus, putting it in?

Dr. MOFFETT. They explained all the electrical materials. We worked with them, decided on the design we wanted, and they made it.

Mr. WEICHEL. This is for one of these set-ups?

Dr. MOFFETT. That is for one of the set-ups.

Mr. BENNETT. They helped in the thought processes as well as the question of building and materials?

Dr. MOFFETT. They gave us the engineering know-how. We would say we wanted to do this and they would say it is not possible from an engineering standpoint since the material is not available and you can't do that sort of thing. As biologists we didn't know about things like that. When they would say "All right, let us try it," so we would put the material together, operate it under experimental conditions, and watch its behavior. We made some very false tries. We did not hit on it the first time.

Mr. BENNETT. What do you expect to try to do with this $400,000, that you have not already done?

Mr. WEICHEL. May I finish with this? That accounts roughly for the first $200,000. You have $600,000. How did you spend the other $400,000?

Dr. MOFFETT. That accounts for the other $250,000. In 1951 we had $197,000. By that time we had acquired a staff. You will remember that in 1950 we did not have one. The staff altogether cost us approximately $133,000.

Mr. WEICHEL. One hundred and thirty-three thousand dollars in addition to you. How many people would that be on the staff?

Dr. MOFFETT. Approximately 35 permanent employees, and as many as 20 part-time or periodic employees.

Mr. WEICHEL. For $135,000?

Dr. MOFFETT. Yes. The $135,000 was for the permanent staff. The periodic employees came under the other.

Mr. WEICHEL. How many on the permanent staff?

Dr. MOFFETT. Thirty-five.

Mr. WEICHEL. How many of those people are trained biologists and experts in fish, and how many others are there. Are the other workers laborers or what?

Dr. MOFFETT. Our average salary is only $3,500 a year.

Mr. WEICHEL. I do not want the average.

Dr. MOFFETT. The organization consists of this: eight——

Mr. WEICHEL. Those are supervisory employees that you are talking about; the staff?

Dr. MOFFETT. No, that is the staff.

Mr. WEICHEL. You mean you call the man a part of the staff who picks up a——

Dr. MOFFETT. He has a classified civil service position; yes, sir.

Mr. WEICHEL. What do you call the people who work for you, is that the only classification that you have, a member of the staff?

Dr. MOFFETT. We include the clerical personnel as well in our staff.

Mr. WEICHEL. What do you call "the staff"? A man who goes out with a staff and brings in a lamprey? Does $35,000 for the staff include everybody?

Dr. MOFFETT. That includes everybody.

Mr. WEICHEL. Out of the 35, are there 35 supervisory and office employees?

Dr. MOFFETT. Supervisory, office, and biologists.

Mr. WEICHEL. That is 35. And you employ 20 other ones once in a while?

Dr. MOFFETT. Off and on. We have to employ laborers occasionally, for maybe 3 months out of the year in order to man these weirs and keep them clean.

Mr. WEICHEL. Those are incidental people. The rest of the people are all supervisors, statisticians, and clerks?

Dr. MOFFETT. That is right. They are—no, not supervisory, they are biologists who were out doing work on various and sundry projects.

Mr. WEICHEL. How many biologists do you have?

Dr. MOFFETT. They are all classified more or less as biologists with the exception of the seven or eight clerical persons.

Mr. WEICHEL. How many biologists are there?

Dr. MOFFETT. Twenty-seven.

Mr. WEICHEL. Twenty-seven biologists?

Dr. MOFFETT. Yes.

Mr. WEICHEL. Those people are trained graduate biologists?

Dr. MOFFETT. All of them with the exception of one have a college degree.

Mr. WEICHEL. Are they biologists?

Dr. MOFFETT. Yes.

Mr. WEICHEL. Specializing in fish?

Dr. MOFFETT. Yes.

Mr. WEICHEL. All 27 of them?

Dr. MOFFETT. That is right.

Mr. WEICHEL. How many stations do you have where you are experimenting?

Dr. MOFFETT. Four. We have one at Ann Arbor, one at Hammond Bay, Marquette, Mich., and Sturgeon Bay, Wis.

Mr. WEICHEL. Do you have seven people at each station?

Dr. MOFFETT. No. We have most of them at Hammond Bay.

Mr. WEICHEL. How many do you have there?

Dr. MOFFETT. I think there are 13.

Mr. WEICHEL. Are they biologists?

Dr. MOFFETT. Either that or fishery aides.

Mr. WEICHEL. Do you pay a fishery aide the same as you do a biologist? How much do you pay a biologist?

Dr. MOFFETT. Their grades run all the way from $3,420—I think that is the new salary classification—up to about $8,500. That is what I get.

Mr. WEICHEL. Is this the first time those people have been engaged in that kind of work, or has there been occasion to hire this type of personnel before?

Dr. MOFFETT. Most of them are fresh out of school.

Mr. WEICHEL. And those people get up to $8,400 a year?

Dr. MOFFETT. No; they do not.

Mr. WEICHEL. How much do the fishery aides get, and who are they?

Dr. MOFFETT. These are the men who are getting only $2,600 and $2,900.

Mr. WEICHEL. And what do they do?

Dr. MOFFETT. They take charge of one of these weirs, they measure them, they sex them, and they assist in all of our electrical experiments. They also catch fish to feed the lampreys in the laboratory. They, in turn, are under the supervision of a GS–11 biologist. That man heads up the Hammond Bay laboratory.

Mr. WEICHEL. So, for the second year in which you spent nearly $200,000, $135,000 went to pay the staff?

Dr. MOFFETT. Right.

Mr. WEICHEL. The rest of it, $65,000, was to purchase equipment?

Dr. MOFFETT. For operational expense and the purchase of equipment.

Mr. WEICHEL. How much was for operational expense? What do you consider operational expense there?

Dr. MOFFETT. This particular breakdown doesn't give it. But the difference would be $135,000 from $197,000.

Mr. WEICHEL. What would the operational expense be? You have $135,000 for the people's pay.

Dr. MOFFETT. You have to buy gasoline to operate the automobiles, and it took a considerable amount of money to operate and outfit the boat, the research vessels. We also have to buy nets.

Mr. WEICHEL. You have already paid for it once. What do you mean by "outfit it"?

Dr. MOFFETT. That contract did not include the scientific equipment.

Mr. WEICHEL. Sir?

Dr. MOFFETT. That contract for its construction did not include scientific equipment. That equipment comes rather high. For instance, we have to pay as much as $700 for a single microscope.

Mr. WEICHEL. Is that on the boat or in the laboratory?

Dr. MOFFETT. That is in the laboratory. We have instruments on the boat, the fathometer, for instance, which cost us better than a thousand dollars.

Mr. WEICHEL. That roughly takes you through the second year. How about the third year?

Dr. MOFFETT. That is the one we are in now.

Mr. WEICHEL. Is that for the fiscal year ending 1952?

Dr. MOFFETT. This is fiscal year 1952 that we are in now.

Mr. WEICHEL. That is the one that you got $300,000-some odd for the fiscal year ending June 30, 1952. How have you disposed of that?

Dr. MOFFETT. We have about $154,000 in salaries, much of that due to the new increase in salaries, and not necessarily to the increase in the number of persons on the payroll. As of February 1 we had liquidated vouchers in station payrolls other than permanent payrolls to the tune of $28,000. There are unliquidated items for which bids or purchase orders have been issued amounting to $61,000. Miscellaneous unliquidated items amounting to $4,078.

Mr. WEICHEL. You have around $350,000, and $150,000 is going to be for personnel. How do you propose to spend the other $200,000?

Dr. MOFFETT. We activated phase 3 of the Cook Electric contract and made a new contract with them. After it was negotiated we did not have the additional money.

Mr. WEICHEL. That was a new contract? What was wrong with the old one?

Dr. MOFFETT. There was some business about transferring money from one fiscal year to another. The deal under the old contract——

Mr. WEICHEL. You did not any money to bring over the old contract?

Dr. MOFFETT. No. That was the trouble. We couldn't supplement the old contract with money from another fiscal year. It is an administrative tangle. I do not think I can explain it.

Mr. WEICHEL. What about the $200,000? You were going to spend $150,000 for salaries. That would leave $200,000 for the ending of the fiscal year, June 1952. This is February. There is February, March, April, May and June—5 months.

Dr. MOFFETT. We have a fair balance of the $150,000 yet to be expended to the tune of about $40,000.

Mr. WEICHEL. You already spent $150,000, you said, for salaries. I am speaking of the $200,000 item. What have you spent the $200,000 for, or is it not spent?

Dr. MOFFETT. No; not all of it.

Mr. WEICHEL. Not all of it?

Dr. MOFFETT. No. But we have bought 15 generators, and 3 more Berkey electric screens, materials for the construction of 6 electric screens, and 12 new blocking devices similar to the mechanical screens you saw, and we are going to have to get a vessel for Lake Superior, a gill-net tug which we figure will cost us about $12,000.

Mr. WEICHEL. You spent $76,000 for the other one. If you are only going to use it for a couple of years, it would have been cheaper to charter one. You spend $76,000 for one 60-foot vessel.

Dr. MOFFETT. There is no such vessel on the Great Lakes that we could charter.

Mr. WEICHEL. How are you going to charter this one, the gill-net tug?

Dr. MOFFETT. We will have to buy it outright. We cannot charter it.

Mr. WEICHEL. Why did you not buy something like that before, instead of having an $75,000 one if you are going to use it for your work for 4 or 5 years?

Dr. MOFFETT. Because the gill-net tug will just fish gill nets.

Mr. WEICHEL. You are speaking about, or rather, you are expecting to use this thing for a period of about 5 years. Instead of making a capital investment running to nearly $100,000, it would have been cheaper, at least it would have been more sensible, to charter something.

Dr. MOFFETT. We are looking toward the future.

Mr. WEICHEL. Do you expect this to go on forever? This has only been talked of for the last 5 years.

Dr. MOFFETT. Not at the tune we have been singing today, no.

Mr. WEICHEL. This started in 1926—go ahead.

Dr. MOFFETT. We expect to put the Cook contract on for $10,000. We expect to negotiate a second bid on electrical generators for $5,000——

Mr. BOYKIN. Is all of that in your statement?

Mr. WEICHEL. I was asking roughly how he was going to spend the $200,000.

Dr. MOFFETT. I just brought these rough notes along.

Mr. WEICHEL. Could you say roughly what you intend to do with the $200,000 in a few words?

Dr. MOFFETT. We are going to carry out the program which I am ready to give you.

Mr. WEICHEL. Are you going to spend $200,000 or $100,000 for the equipment? I did not ask about the chicken feed of $5,000 against $200,000.

Dr. MOFFETT. It mounts up when you add it together.

Mr. WEICHEL. In other words, you are going to spend $200,000 for additional equipment, in addition to what you already bought?

Dr. MOFFETT. Yes. We will have in the stream at that time some 12 functional electrical devices so equipped that we can tell how many lampreys are let into the field of electricity, how many get through the field of electricity and go out. Our major objective as of this spring is to find out the engineering involved in this electrical principle. We have to develop it. We have to be able to say how far apart we put these electrodes.

Mr. WEICHEL. That answers that. For the fiscal year ending 1952, how many hundred thousand more do you want?

Dr. MOFFETT. For 1953?

Mr. WEICHEL. For 1952 and 1954.

Dr. MOFFETT. We need $466,000.

Mr. WEICHEL. On top of that?

Dr. MOFFETT. That is the total.

Mr. WEICHEL. How are you going to spend that $400,000 that you are asking for?

Dr. MOFFETT. We are going to put on every stream that is a tributary to Lake Superior that we know carries sea lampreys—and we have survey parties out and they have walked every foot of every stream in the State of Michigan and we will soon walk every foot of every stream tributary in the State of Wisconsin—tributary to Lake Superior—and we will put 23 structures on Lake Superior and operate them in the same fashion as though they were put in there to do control work.

In other words, we selected Lake Superior for two reasons: One, it still has a remnant stock of lake trout that we might possibly save. The other reason is that it is the most difficult terrain of the entire Great Lakes' drainage to get at; and, if we can do it there, it is a certainty, absolutely, that it can be done anywhere else.

Mr. WEICHEL. With reference to Lake Superior, that is the one that showed an increase of production of lake trout. That is where you are going to do it? You are not going to do it in a place where they are going to take it away?

Dr. MOFFETT. We feel a frontal attack is better than coming around behind the door. Maybe that is a fallacy in our strategy. If we can save the Lake Superior lake trout stock, I think that is good sense. Would you not admit that?

Mr. WEICHEL. That is what I am trying to find out. The place where you have caught more than the average, that is where you are going to do it. The place where you do not catch any, or where it has been cut down, such as Lake Michigan and Lake Huron—as to what results you can get out of that, where there are not any trout; that is interesting.

That is all that I have.

Mr. ALLEN. Mr. Chairman, getting back to the question I asked a half hour ago, I would like a couple of answers on that. I think you said it would be $469,000, whatever the figure was, for fiscal 1953, as things look now, winding up this phase of the project.

Dr. MOFFETT. Yes, sir.

Mr. ALLEN. About a year ago the bill requested $500,000 for 5 years, which would be $2,500,000. It is now estimated that $469,000 plus some $300,000, possibly $800,000, was all that was needed to have been estimated.

I would like to know how the representation happened to have been made a year ago estimating it would cost us $2,500,000.

Dr. MOFFETT. Well, sir, we didn't have the answer then, as you will recall. We were fiddling with these electrical devices but did not have anything to offer you as a concrete principle. We were requesting the authorization so that if it was necessary for us to go on—we are exploring the other fields, for instance we have a poison that is highly selective to these lamprey larvae in the stream, but we have to treat that in relation to other fishes, both as to foods and other things, and association, before we can pull the plug on it. We did not know, when we were asking you, whether we were going to be successful or not.

We figured it might take five or maybe longer years to get the job done. We were lucky. We hit it. We now feel that we have the gimmick.

Mr. ALLEN. I can appreciate that there was a good deal of guessing at that time. I wonder who was responsible for the procedure of coming up with a 5-year appropriation rather than going from year

to year. I ask that question partly because we were subjected to some criticism here in the committee as I remember it because we did not want to go along with an appropriation for 5 years when we did not have any information here.

I wonder who is responsible in the Fish and Wildlife Service, if that is where the responsibility lies, for giving us an estimate which proves some 2½ times more than what is actualy required in the long run.

Dr. MOFFETT. I think I was responsible for the original ideas. You see, after we get the authorization, we still have to fight it through the Appropriations Committee. We also have to fight it through our Bureau of the Budget. Last year you gave us an authorization of 1 year. By the time that was—that was for $500,000. By the time it went through the Bureau of the Budget and the Appropriations Committee it was $150,000 additional money.

Mr. ALLEN. I appreciate that. We also have the proposition of the Appropriations Committee people criticizing the legislative people for authorizing appropriations without regard to keeping expenses down. For my part, I would like an accurate estimate of what the legislative program is likely to be. I am not criticizing you for guessing on the future. I think you have to. But I do think that in this case it was proven that the guessing was a little liberal.

Dr. MOFFETT. I think your judgment was very, very wise. As it turned out, it was very wise. I would like to correct an impression at this time, before the hearing is over, that as far as the research is concerned on sea lamprey we will be through. But the job is far from done. We are not going to require any sums like we are talking about as of today, but sometime, as soon as the sea lamprey is done, somebody is going to say, "What are you going to do about lake trout? They won't necessarily get back on their feet by themselves."

Mr. BENNETT. When do you think the sea lamprey investigation will end?

Dr. MOFFETT. I think we can write a manual of procedure in the control of the sea lamprey after the 1953 fiscal year is done.

Mr. BENNETT. You think the $400,000 is required to end the lamprey program?

Dr. MOFFETT. So that we can put out the engineering specifications on a standardized unit that anybody can build and install.

Mr. BENNETT. You think it is necessary?

Dr. MOFFETT. I really do.

Mr. BENNETT. You do think it will end, so far as the sea lamprey is concerned, within 1 year, with this $400,000?

Dr. MOFFETT. That is right.

Mr. BENNETT. Why do you think such a large area as Lake Superior is required for the final test?

Dr. MOFFETT. There are tactics and strategy involved which we know nothing about. We consider this a dress rehearsal. It will control sea lampreys at the same time, but we consider it a dress rehearsal which will give the information so that we can in the future, for an agency or group of agencies or whoever carries out the control phase, give something better than a guess as to cost of the over-all operation, when they get into control of the sea lamprey seriously.

Mr. BENNETT. You said something when the motion picture was on, about the devices and their location. Are the devices that you are now using and have been using located in areas where you would like to see them placed or are they located because of some political purpose?

Dr. MOFFETT. No; that was just a passing remark?

Mr. BENNETT. You just said that in a jocular vein; is that right?

Dr. MOFFETT. Yes.

Mr. BENNETT. Is the mouth of Lake Superior presently closed to the entry of further comings of these lampreys?

Dr. MOFFETT. No, sir.

Mr. BENNETT. Would that be a practical procedure?

Dr. MOFFETT. It would be a practical procedure. We have considered the possibility of attempting to find measures to cut off reinfection and when the Great Lakes seaway ever becomes anywhere around a reality it might be possible.

Mr. BENNETT. One final question. Does a lamprey customarily utilize its entire life span within the Great Lakes or does it go back to the sea?

Dr. MOFFETT. They never go back to the sea.

Mr. BENNETT. Do they go between the Great Lakes to any great extent?

Dr. MOFFETT. Yes; freely, between Lake Michigan and Lake Huron. We haven't had any of the tagged specimens turn up in Lake Superior. That doesn't mean they don't go back and forth on boats.

Mr. BENNETT. I have been very much impressed by your testimony here and the testimony of some of the other people who have testified. I would like, for my own part and on the part of the committee, to say that we are very happy that apparently your work has found a solution to this terrible thing. We, when we first authorized this work, were not at all sure that any beneficial results would come from it. I am glad that you have some hope.

Mr. BOYKIN. I certainly agree with Mr. Bennett. I would like to ask you once more: Do you not think that just—well, that you just ought to take this electricity and put enough in there to kill everything that comes that way, even if you had to kill some of the good fish? These fellows that the game warden caught on my own place, they said it did not kill the scale fish, just the big catfish that didn't have scales. They never let any of the others come up at all. Do you not think that you could kill every one, put it across the mouth and get them, even if you had to get some of the others?

Mr. MOFFETT. We fully intend to do that, sir.

Mr. WEICHEL. The place that you are going to use to prove the lamprey problem is a place where nothing has been done and where they have increased their production 300,000 pounds without anything. That is the place where you are going to spend money to prove it. In Lake Michigan, where it has been depleted, and Lake Huron, where they are, it seems to me that would be the place to prove something with reference to the lamprey eel, with reference to what it does to fish.

Do you intend to prove, by that, that you are going to get a better and bigger increase? What they are trying to do is to bring back what is gone via the lamprey. How do the waters from the lower lake get to Lake Superior. It all goes through St. Marys River.

Dr. MOFFETT. Lake Superior has its own group. They are growing in numbers.

Mr. WEICHEL. You said they come from the lower lakes.

Dr. MOFFETT. That is how they got in there.

Mr. WEICHEL. St. Marys River is the only way. Part of it is only 200 feet wide at the—you say they have their own particular group of lampreys there. The production has increased. It seems nonsensical to go there and spend $400,000 where it has increased without any control, instead of doing it somewhere else. Or are you going to come back with another million dollars to prove it down in Lake Michigan where the fish are being destroyed by lampreys. That doesn't make any sense to me.

Dr. MOFFETT. The sea lamprey did not make it into Lake Superior quite as readily as it did into Lake Michigan and Lake Huron.

Mr. WEICHEL. But they have increased in Lake Superior, and at the other places they decreased.

Dr. MOFFETT. The sea lamprey is increasing at Lake Superior——

Mr. WEICHEL. I am talking of fish production, not the eels themselves. We are only spending this money and talking about it because of the production which has increased up there without anything, and where it has decreased you are not going to do anything with the $400,000 that you want.

Dr. MOFFETT. Our object is to keep that population in Lake Superior, if we possibly can.

Mr. WEICHEL. It is keeping itself. It has increased 300,000 pounds. That is in spite of what you have done.

Mr. MOFFETT. The future won't necessarily go that way. As a matter of fact, if you look closely at the statistics you will notice that Lake Michigan is at one of its high peaks, it was just before the terrific crash. The fluctuation of Lake Superior to the tune of 200,000 pounds over all is not abnormal.

Mr. WEICHEL. It has increased without anything. But the place where they are being cut down, you are not doing anything there. Do you have to have millions of dollars to prove it in Lakes Michigan and Huron? It seems to me that is the place to prove what you are talking about.

Dr. MOFFETT. The sea lamprey is just now getting well established in Lake Superior. If I may use an analogy, it is like killing the first two flies and then you do not have to worry about the rest. After you get a house full of them, you really have a problem on your hands.

(The information referred to follows:)

Mr. WEICHEL. When you get through at Lake Superior, all you will be able to prove is that you are going to get more than you get without it. What you are trying to get is to get them down in the other lakes. That is what I understand the problem is.

Dr. MOFFETT. They will not turn around and go back down St. Marys River.

Mr. WEICHEL. They won't?

Dr. MOFFETT. No.

Mr. BOYKIN. They eat everything as they go.

Gentlemen, we have certainly enjoyed having you here. We will look at the records that Mr. Weichel asked to have sent up. We will have them put in the record. I think all of us have enjoyed your

wonderful talk, especially the picture. That picture was great. It really let us see what was going on and where you spent the money. It has been a pleasure having you here, gentlemen.

Dr. MOFFETT. Thank you, sir. We appreciated the opportunity of being here with you.

(The following information was subsequently supplied for the record:)

STATEMENT OF DR. JAMES W. MOFFETT REGARDING THE REQUESTED BUDGET FOR FISCAL YEAR 1953

The Great Lakes fishery investigation has progressed rapidly into the assigned problem of sea-lamprey study and the development of methods for eventual control. Explorations into possible control measures received a great impetus when the Congress appropriated some $279,000 for fiscal year 1950. Progress was slowed somewhat in fiscal year 1951 when only $202,000 were made available. Additional reductions in the regular appropriation for fiscal year 1952 to $188,000 enforced further retrenchment which would have limited progress ruinously had not the authorization for this project been increased by Congress. A supplemental appropriation resulting from the increase in authorization made available an additional fund of $150,000 which will enable the achievement of planned experimental objectives intended to refine control procedures. The 1952 research program will provide designs and information on operating characteristics of electrical sea-lamprey control devices and also some of the sorely needed facts on the relationship between the limnology of the Great Lakes, their fish stocks, and sea-lamprey populations.

As requested by your report No. 558 on H. R. 2005, Eighty-second Congress, first session, which was approved July 30, 1951, as Public Law 94, there is submitted a budget estimate to cover the program of the Great Lakes fishery investigations, United States Department of the Interior, Fish and Wildlife Service, for the period July 1, 1952, to June 30, 1953. The total budget request involves a sum amounting to $446,000. This amount is considered necessary to execute the program which has been outlined in this testimony.

It is for this reason that the budget estimate for 1953 was set at $446,000. The purpose of our request for this sum lies in the fact that we feel relatively certain that we have discovered an economical means of controlling sea lampreys in the Great Lakes. The use of electrical barriers seems very promising and should be explored to the limits of our ability. On the basis of tests of equipment to be made during the current year's (1952) program, the Fish and Wildlife Service expects to install proven sea-lamprey control devices in streams tributary to the United States waters of Lake Superior. Previous surveys of all streams entering Lake Superior from State of Michigan drainages revealed established sea-lamprey spawning runs in 23 streams. One of these streams is blocked by an experimental electric screen. Funds requested for 1953 will provide for installation and operation of 22 additional structures. The purpose of this program is to operate, on a pilot basis, a sufficient number of control structures to learn the problems involved in supply, care, maintenance, and continuous, high-standard functioning. Such experience will furnish a basis for planning an all-out campaign of effective control and for intelligent cost analysis of the total control effort.

The sea lamprey did not enter Lake Superior until 1947. Lake Superior, for the first time in 1952, will produce in its own streams millions of parasitic lampreys. Up to this time all have come from Lakes Huron and Michigan. Furthermore, there is a rather large population of lake trout still remaining in Lake Superior, and it is possible that this population can be conserved by such action.

This pilot operation will provide also a high measure of effective control over ever-increasing stocks of sea lampreys in Lake Superior. It is reasoned that control of the sea-lamprey population before it has entirely ruined the lake trout and other stocks of fish in Lake Superior is good conservation.

Satisfaction with the encouraging results of experiments with electrical barriers must be tempered with the realization of the pressing urgency for more adequate research on the lake phase of the sea lamprey's life cycle and on the stocks of fish already reduced or gravely threatened directly or indirectly by the depredations of that parasite. Delay by a single season can spell further

disaster to the fisheries. The once prosperous lake trout fishery has disappeared in the United States waters of Lake Huron and has dwindled to insignificance in Lake Michigan. In Lake Superior, the only remaining domestic source of significant quantities of lake trout, production has been steady, but statistical researches by Service investigators have proven that the fishery actually faces collapse. In the State of Michigan waters the output has been maintained by increasing fishing pressure more and more as the abundance of fish has declined rapidly toward a critical level. If present trends continue, an early collapse of the fishing industry in Lake Superior is to be anticipated. Furthermore, species not subject to extensive sea-lamprey attacks are threatened by transfers of fishing pressure by fishermen forced to seek new grounds. In the highly productive waters of northern Green Bay (Lake Michigan), for example, the fishing pressure on some of the major species has increased five- to tenfold or more within the last 5 or 6 years. Changes in stocks subject to greatly increased fishing intensity should be followed closely.

Operation of the research vessel *Cisco* and accessory craft at Sturgeon Bay on Lake Michigan, at Hammond Bay on Lake Huron, and at Marquette on Lake Superior during the period of open water in fiscal year 1953 is vital to proper development of our knowledge of the lake or parasitic phase of the sea lamprey's life cycle. Opportunity has been lacking even to explore the possibility of capture and destruction of sea lampreys at the time of concentration off river mouths in late fall and winter. These gaps in our information should be filled.

We need also more facts on the fish themselves—their seasonal movements, distribution, and abundance and the factors controlling them. Better knowledge here not only can help avoid overexploitation of species reduced in abundance but also can contribute to a more efficient utilization of abundant varieties and thus ease the economic difficulties of the fishermen. Most valuable, for example, would be information on the summer distribution of lake herring in Lakes Michigan, Huron, and Superior which would permit the more extensive exploitation of that species in the spring and summer when better prices are to be had than during the heavy spawning-run production. Furthermore, vessel operation offers the only means of following changes in the abundance of lake trout in Lakes Michigan and Huron where commercial fishing for the species has been abandoned. Finally, the vesssel in Lake Superior will have the additional duty of transporting equipment and supplies to remote sites of experimental installations not accessible by road. For effective operation the research vessels must be equipped with a variety of specially constructed gill nets, trawls, and other gear.

Many of the projects undertaken in past years are now being brought to conclusion. The support of these investigations must be continued if we are to realize full benefit from their findings. Two of these studies, as will be seen from the following paragraphs, have yielded rather startling results; the findings of both of them must be expanded upon in order to capitalize on their contribution to the use and control of sea lampreys.

An extensive investigation into the mechanics and physiology of sea lamprey feeding will be concluded by the beginning of fiscal year 1953. This work has demonstrated, among other things, the presence of a powerful anticoagulant in the salivary secretion of the sea lamprey. In anticipation of a possible use of this compound in medicine we intend to explore its composition, properties, and availability.

A search for an effective and selective larvicide for use against the hordes of young sea lamprey larvae in the silt beds of streams is also showing definite promise of success. Many hundreds of likely compounds have been tested to ascertain their killing effect and selective action against lampreys without harmful effects on fishes. Several of these compounds kill larvae at relatively low concentrations without harming fishes (goldfish) in the test aquaria. Development of field procedures for the practical application of this demonstrated selectivity may provide means for immediate control of the entire population of larval sea lampreys residing in a given stream. The ideal arrangement for immediate and continuing control for the sea lamprey would consist of an electrical device to stop the spawning migration of adult lampreys and the use of a larvicide to kill all year classes of a population residing in a stream. Such an operation may never be practical in all streams inhabited by sea lampreys; however, where it can be achieved it would mean that complete control and immediate relief from parasitic attacks on lake fish would result from 1 year's operation. The program for 1953 includes field trials of these chemicals and experiments to test selectivity with respect to other species of fish and associated food organisms.

The value of systematic analysis of fishery statistics has been proven beyond doubt. This activity is generally taken for granted in our investigation, but it requires considerable effort, time, and money to make the statistics available. These statistics are extremely worth while in that they furnish indexes of the abundance of various stocks of commercial fishes harvested each year in the Great Lakes. By means of the statistics we are able to follow the probable abundance of catchable stock and to detect evidences of over- or under-exploitation. By means of the statistics we can also anticipate possible areas of scarcity. It is also possible for us to predict the likely course of catch successes in years to come.

According to our estimates the costs for capital investment and for operation will amount to approximately $136,000. The Service also intends to continue its inventory of streams tributary to Lake Superior and located in Wisconsin and Michigan. This work is to be done with the greatest amount of speed so that a cost estimate can be made covering all of the United States waters tributary to Lake Superior which now contain sea lampreys. The Service proposes further to conduct its usual operations in a manner sufficient to yield details needed in sea lamprey control on Lake Michigan. We believe that evidence leading to the application of control measures without delay is of the utmost value in saving what is left of the Lake Michigan lake trout fishery. Preliminary studies will also be made on the lake trout and other fish populations in Lake Huron and other studies intended for Lake Superior will complete our program essentially as it was outlined to you.

The various categories into which this budget estimate is divided are as follows:

Permanent full-time salaries		$214,900
Wages and other personal services which include laborers and part-time employees		23,600
Travel and subsistence for staff members involved in the execution of the Lake Superior program and our studies elsewhere		29,500
Our requirements for transportation of things, communications services, rents and utilities, printing and reproduction will involve		19,000
Contractual services intended for the Cook Electric Co.'s research laboratory, for repairs to cars and trucks, boats and motors, electrical generators and for clearing access trails to control sites		39,000
Supplies and materials including fish tags, chemicals and laboratory supplies, gas and oil for automobiles, boats, tractors, etc., equipment repairs and repairs to existing control structures		47,000
Equipment and costs of outfitting the new pilot control operation on Lake Superior: Under this category come many of the known recurring items involved in this pilot-control operation. It will be necessary to buy boats and outboard motors, nets and seines, scientific equipment, trucks, tools, electric generators, and electric fish screens. Larger items involved in this category will require:		
Nets and seines	$10,000	
Trucks	14,000	
Electric generators and Burkey electric fish screens	26,200	
Control structure equipment and tools	9,100	
		73,000
Total		446,000

PUBLICATIONS BY STAFF MEMBERS OF GREAT LAKES FISHERY INVESTIGATIONS, FISH AND WILDLIFE SERVICE, AS OF FEBRUARY 1952

Applegate, Vernon C.:

1950: The sea lamprey in the Great Lakes. Scientific Monthly, Vol. 72, No. 5, May (1951), pp. 275–281 and USFWS Fish. Leaflet 384, Oct., (1950), 11 pp.

1951:

Natural history of the sea lamprey in Michigan. USFWS Spec. Sci. Rept.: Fish. No. 55, 237 pp.

Sea lamprey investigations. II. Egg development, maturity, egg production, and percentage of unspawned eggs of sea lampreys, *Petromyzon marinus*, captured in several Lake Huron tributaries. Paps. Mich. Acad. Sci., Arts, and Letts., Vol. 35 (1949), pp. 71–90.

Applegate, Vernon C. and Clifford Brynildson:
1952: Downstream movement of recently transformed sea lampreys, *Petromyzon marinus*, in the Carp Lake River, Michigan. Trans. Am. Fish. Soc., Vol. 81 (1951), (in press).
Applegate, Vernon C. and Bernard Smith:
1950: Sea lamprey spawning run in the Great Lakes in 1950. USFWS Spec. Sci. Rept.: Fish. No. 61, 49 pp.
1951: Movement and dispersion of a blocked spawning run of sea lampreys in the Great Lakes. Trans. 16th N. Am. Wildlife Conf., pp. 243–251.
Applegate, Vernon C., Bernard Smith, Alberton McClain, and Matt Patterson:
1952: Sea lamprey spawning runs in the Great Lakes in 1951. USFWS Spec. Sci. Rept. (in press).
Cable, Louella E.:
1950: A cheek tag for marking fish, with semiautomatic pliers for application of tag. Jour. du Conseil, Vol. 16, pp. 185–191.
Deason, Hilary J.:
1932:
A study of surface currents in Lake Michigan. The Fisherman, Vol. 1, No. 5, pp. 3, 4, and 12.
Scientific investigation of chub net fishing in Lake Michigan. The Fisherman, Vol. 1, No. 4, pp. 3, 4, 11, and 12.
1933:
Geological formation of Great Lakes. The Fisherman, Vol. 2, No. 3, pp. 3, 4, and 10.
Feeding adaptations in fishes. The Fisherman, Vol. 2, No. 7, pp. 3, 4, 10, and 11.
Preliminary report on the growth rate, dominance, and maturity of the pikeperches (*Stizostedion*) of Lake Erie, Trans. Am. Fish. Soc., Vol. 63, pp. 348–360.
1934: The development of fishes, tracing the natural development from egg to fry. The Fisherman, Vol. 3, No. 11, pp. 1, 3.
1936: Bottles set adrift on Lake Michigan yield information on surface currents. Mich. Cons., Vol. 6, No. 6, p. 9.
1939: The distribution of cottid fishes in Lake Michigan. Paps. Mich. Acad. Sci., Arts, and Lett., Vol. 24, Pt. 2 (1938), pp. 105–115.
Deason, Hilary J., and Ralph Hile:
1947: Age and growth of the kiyi, *Leucichthys kiyi* Koetz, in Lake Michigan. Trans. Am. Fish. Soc., Vol. 74 (1944), pp. 88–142.
Duden, William:
1933: Recent advances in the fishing industry. Part I. The Fisherman, Vol. 2, No. 10; Pt. II, Ibid No. 10.
Gallagher, H. R., and John Van Oosten:
1943: Supplemental report of the United States members of the International Board of Inquiry for the Great Lakes Fisheries. Pp. 25–213.
Gallagher, H. R., A. G. Hunstman, D. J. Taylor, and John Van Oosten:
1943: Report of the International Board of Inquiry for Great Lakes Fisheries. 24 pp.
Hile, Ralph:
1931: The rate of growth of fishes of Indiana. Investigations of Indiana Lakes, No. 2, pp. 9–55.
1932: Fish scales and commercial fisheries. The Fisherman, Vol. 1, No. 10, pp. 3–4, 10.
1934: Causes of variation in the growth rates of fishes. The Fisherman, Vol. 3, No. 2, pp. 3–4, 10–11.
1935: Daily reports reveal new facts and figures. The Fisherman, Vol. 4, No. 12, pp. 1–2.
1936:
Low production may not mean depletion. The Fisherman, Vol. 5, No. 2, pp. 1–2.
Age and growth of the cisco *Leucichthys artedi* (LeSeur), in the lakes of the northeastern highlands, Wisconsin. Bull. U. S. Bur. Fish., Vol. 48, (Bull. 19), pp. 211–317.
Summary of investigations on the morphometry of the cisco, *Leucichthys artedi* (LeSeur), in the lakes of the northeastern highlands, Wisconsin. Paps. Mich. Acad. Sci., Arts, and Lett., Vol. 21 (1935), pp. 619–634.
Age determination of fish from scales; method and application to fish cultural problems. The Prog. Fish-Cult., Bur. Fish. Memo. I–131, No. 23, pp. 1–5.

1937:
Morphometry of the cisco, *Leucichthys artedi* (LeSeur), in the lakes of the northeastern highlands, Wisconsin. Internationale, Rev. der gesamten Hydrob. und Hydrog., 1937, Bd. 36, Heft 1/2, S. 57–130.
The increase in the abundance of yellow pike-perch, *Stizostedion vitcrum* (Mitchill), in Lakes Huron and Michigan, in relation to the artificial propagation of the species. Trans. Am. Fish. Soc., Vol. 66 (1936), pp. 143–159.
1941: Age and growth of the rock bass, *Ambloplites rupestris* (Rafinesque), in Nebish Lake, Wisconsin. Trans. Wis. Acad. Sci., Arts, and Lett., Vol. 33, pp. 188–337.
1942: Growth of the rock bass, *Ambloplites rupestris* (Rafinesque), in five lakes of northeastern Wisconsin. Trans. Am. Fish. Soc., Vol. 71 (1941), pp. 131–143.
1943: Mathematical relationship between the length and the age of the rock bass, *Ambloplites rupestris* (Rafinesque). Pap. Mich. Acad. Sci., Arts, and Lett., Vol. 28 (1942), pp. 331–341.
1948: Standardization of methods of expressing lengths and weights of fish. Trans. Am. Fish. Soc., Vol. 75 (1945), pp. 157–164.
1949:
Trends in the lake trout fishery of Lake Huron through 1946. Trans. Am. Fish. Soc., Vol. 76 (1946), pp. 121–147.
Structure and senses of fish. Fish. Leaflet 132 of the Fish and Wildlife Service, 13 pp.
1950:
Green Bay walleyes. A report on the scientific investigation of the marked increase in the abundance of walleyes in Green Bay. The Fisherman, Vol. 18, No. 3, pp. 5 and 6.
A nomograph for the computation of the growth of fish from scale measurements. Trans. Am. Fish. Soc., Vol. 78 (1948), pp. 156–162.

Hile, Ralph and Hilary J. Deason:
1934: Growth of the whitefish, *Coregonus clupeaformis* (Mitchill) in Trout Lake, northeastern highlands, Wisconsin. Trans. Am. Fish. Soc., Vol. 64, pp. 231–237.
1947: Distribution, abundance, and spawning season and grounds of the kiyi, Leucichthys kiyi Koelz, in Lake Michigan. Trans. Am. Fish. Soc., Vol. 74 (1944), pp. 143–165.

Hile, Ralph and William R. Duden:
1933: Methods for the investigation of the statistics of the commercial fisheries of the Great Lakes. Trans. Am. Fish. Soc., Vol. 63, pp. 292–305.

Hile, Ralph, Paul H. Eschmeyer, and George F. Lunger:
1950: Decline of the lake trout fishery in Lake Michigan. USFWS Fish., Vol. 52, Bull. 60, pp. 77–95.
1951: Status of the lake trout fishery in Lake Superior. Trans. Am. Fish. Soc., Vol. 80, (1950), pp. 278–312.

Hile, Ralph and Frank W. Jobes:
1941: Age, growth, and production of the yellow perch, *Perca flavescens* (Mitchill), of Saginaw Bay. Trans. Am. Fish. Soc., Vol. 70 (1940), pp. 102–122.
1942: Age and growth of the yellow perch, *Perca flavescens* (Mitchill), in the Wisconsin waters of Green Bay and northern Lake Michigan. Pap. Mich. Acad. Sci., Arts, and Lett., Vol. 28 (1941), pp. 241–266.

Hile, Ralph and Chancey Juday:
1941: Bathymetric distribution of fish in lakes of the northeastern highlands, Wisconsin. Trans. Wis. Acad. Sci., Arts, and Lett., Vol. 33, pp. 147–187.

Jobes, Frank W.:
1932: Deep trapnets on Lakes Huron and Michigan. The Fisherman, Vol. 1, No. 3, pp. 3–4.
1933: Preliminary report on the age and growth of the yellow perch (*Perca flavescens* Mitchill) from Lake Erie, as determined from a study of its scales. Pap. Mich. Acad. Sci., Arts, and Lett., Vol. 17 (1932), pp. 643–652.
1943: The age, growth, and bathymetric distribution of Reighard's chub *Leucichthys reighardi* Koelz, in Lake Michigan. Trans. Am. Fish. Soc., Vol. 72 (1942), pp. 108–135.

1949:
The age, growth, and distribution of the longjaw cisco, *Leucichthys alpenae* Koelz, in Lake Michigan. Trans. Am. Fish. Soc., Vol. 76 (1946), pp. 215–247.
The age, growth, and bathymetric distribution of the bloater, *Leucichthys hoyi* (Gill), in Lake Michigan. Pap. Mich. Acad. Sci., Arts, and Lett., Vol. 33 (1947), pp. 135–172.
1952: Age, growth, and production of yellow perch in Lake Erie. USFWS Fish. Bull. (in press).

Jobes, Frank W. and Minna E. Jewell:
1927: Studies on the alkali reserve of the blood of *Ameiurus nebulosus* from acid and basic waters. Trans. Am. Micro. Soc., Vol. 46, pp. 175–186.

Krumholz, Louis A. and Ralph Hile:
1944: Fillet weights and loss in filleting of yellow pikeperch, *Stizostedion v. vitreum* (Mitchill), from Saginaw Bay, Nov. 1942, May 1943, and April 1944. Inst. Fish. Res., Michigan Dept. Cons., Rept. No. 973, 5 pp., (Mimeo.)

Loeb, Howard and Albert E. Hall, Jr.:
1952: Sea lamprey spawning: Michigan streams of Lake Superior. USFWS Spec. Sci. Rept. (in press).

McClain, Alberton:
1952: Diseases and parasites of the sea lamprey, *Petromyzon marinus*, in the Lake Huron basin. Trans. Am. Fish. Soc., Vol. 81 (1951), (in press).

Moffett, James W.:
1950: Sea lamprey control. Michigan Conservation, Vol. 19, No. 4, pp. 18–20.
1952: The study and interpretation of fish scales. Focus and The Science Counselor (in press).

Mraz, Donald:
1952: Movements of yellow perch marked in southern Green Bay, Lake Michigan, 1950. Trans. Am. Fish. Soc., Vol. 81 (1951), (in press).

Perlmutter, Alfred:
1951: An aquarium experiment on the American eel, *Anguilla rostrata* (LeSueur), as a predator on larval lampreys. Copeia, No. 2, pp. 173–174.

Scott, Will, Ralph Hile, and H. T. Spieth:
1938: The bottom fauna of Tippicanoe Lake. Investigations of Indiana Lakes and Streams, No. 4, pp. 3–16.

Smith, Oliver H. and John Van Oosten:
1940: Tagging experiments with lake trout, whitefish, and other species of fish from Lake Michigan. Trans. Am. Fish. Soc., Vol. 69 (1939), pp. 63–84.

Van Oosten, John:
1923: The study of the scales of whitefishes of known ages. Zoologica, Vol. 2, No. 17, pp. 280–412.
1926: Report of a preliminary survey of conditions in the Sandusky Bay region, Ohio, with special reference to the destructiveness of commercial nets. Bur. Fish., Fish. Serv. Bull. 136, Sept., pp. 1–25.
1928: Scientific investigations of Great Lakes fisheries by the U. S. Bureau of Fisheries. Second G. L. Fish. Conf. Meeting held at Lansing, Mich., Feb. 8, 1928, Mich. Dept. Cons., pp. 16–20.
1929: The life history of the lake herring (*Leucichthys artedi* LeSueur) of Lake Huron as revealed by its scales, with a critique of the scale method. Bull. Bur. Fish., Vol. 44, pp. 265–428.
Some fisheries problems on the Great Lakes. Trans. Am. Fish. Soc., Vol. 59, pp. 63–85.
1930: Investigation of method of measuring twine in Great Lakes district. Mich. Fisherman, Vol. 14, No. 4, pp. 1 and 6.
The disappearance of the Lake Erie cisco—a preliminary report. Trans. Am. Fish. Soc., Vol. 60, 204–214.
1932: The maximum age of fresh-water fishes. The Fisherman, Vol. 1, No. 11, pp. 3–4.
Experiments on the mesh of trapnets on Lake Erie. The Fisherman, Vol. 1, No. 12, pp. 3–4, 8.
Review of Great Lakes work conducted by the U. S. Bureau of Fisheries. The Fisherman, Vol. 2, No. 1, pp. 3–4, 8.
Experiments on the mesh of trapnets and legislation of the commercial fisheries of Lake Erie. Trans. Am. Fish. Soc., Vol. 62, pp. 100–107.
1933:
Preliminary report on investigation of chubnet meshes in Lake Michigan. The Fisherman, Vol. 2, No. 4, pp. 3–4, 8.
Recent developments in commercial fishing industry. Trans. Am. Fish. Soc., Vol. 63, pp. 31–35.

1934:
The value of questionnaires in commercial fisheries regulations and surveys. Trans. Am. Fish. Soc., Vol. 64, pp. 107–117.
On the deep trapnet in the State of Michigan. Mich. Tradesman, No. 2674, p. 25.
1935:
Questionnaires prove valuable to fisheries. The Fisherman, Vol. 4, No. 6, pp. 1–2.
Logically justified deductions concerning the Great Lakes fisheries exploded by scientific research. Trans. Am. Fish. Soc., Vol. 65, pp. 71–75.
Lake states change fishery regulations. The Fisherman, Vol. 4, No. 10, pp. 1–2.
First record of the alewife, *Pomolobus pseudo-harengus*, for the State of Michigan. Copeia, (1935), No. 4, pp. 194–195.
1936:
Fishing industry of the Great Lakes. Bur. Fish. Memo. I–63, 13 pp.
Dr. Van Oosten reveals startling data. Gold Metal Netting News, Vol. 9, pp. 1–2.
A new immigrant comes to Michigan. The Fisherman, Vol. 5, No. 6, pp. 1 and 3.
Age of fish determined from scales. The Fisherman, Vol. 5, No. 6, pp. 1 and 3.
Net selectivity on the Great Lakes. Gold Medal Netting News, Vol. 10, July, pp. 2–3.
The mortality of fish in Lake Erie. Great Lakes Fisherman, Vol. 1, No. 3, pp. 2 and 16.
Lake fisheries facing extermination. The fisherman, Vol. 5, No. 11, pp. 1 and 3.
The North Central States Wildlife Conference. The Prog. Fish.-Cult., Bur. Fish. Memo. I–131, No. 26, pp. 15–19.
Doom of the Great Lakes fisheries. Am. Forests, Vol. 43, pp. 103–105, 144–145.
First records of the smelt, *Osmerus mordax*, in Lake Erie. Copeia, 1937, No. 1, pp. 64–65.
The age, growth, and sex ratio of the Lake Superior longjaw, *Leucichthys zenithicus* (Jordan and Evermann). Pap. Mich. Acad. Sci., Arts, and Lett., Vol. 22 (1936), pp. 691–711.
The artificial propagation of the commercial species of fish of the Great Lakes. Prog. Fish.-Cult., U. S. Bur. Fish. Memo. I–131, No. 28, pp. 8–15.
Artificial propagation of commercial fish of the Great Lakes. Trans. 2nd N. Am. Wild. Conf., pp. 605–612.
The Great Lakes fisheries: their proper management for sustained yields. Trans. Am. Fish. Soc., Vol. 66 (1936), pp. 131–138.
The dispersal of smelt, *Osmerus mordax* (Mitchill), in the Great Lakes region. Trans. Am. Fish. Soc., Vol. 66 (1936), pp. 160–171.
1938:
The extent of the depletion of the Great Lakes fisheries. Proc. Great Lakes Fish. Conf., Feb. 25–26, pp. 10–17.
Michigan's commercial fisheries of the Great Lakes. Mich. Hist. Mag., Vol. 22, pp. 3–39.
The age and growth of the Lake Erie sheepshead, *Aplodinotus grunniens* Rafinesque. Pap. Mich. Acad. Sci., Arts, and Lett., Vol. 23 (1937), pp. 651–668.
From cisco to perch to pike. State Gov't, Vol. 11, No. 3, pp. 55–57.
1939:
Battle rages over closing Potagannissing Bay to commercial fishermen. Mich. Game Trails, Vol. 1, No. 3, pp. 19–20.
Save the Great Lakes fisheries. Outdoor Am., Vol. 4, No. 3, pp. 4–5, 7.
Can the Great Lakes fisheries be saved? Am. Wildlife, Vol. 28, No. 3, pp. 129–135.
Age, growth, sexual maturity, and sex ratio of the common whitefish, *Coregonus clupeaformis* (Mitchill), of Lake Huron. Paps. Mich. Acad. Sci., Arts, and Lett., Vol. 24, Pt. 2, 1938), pp. 195–221.
A common concern . . . Great Lakes fisheries for anglers and fishers. Mich. Game Trails, Vol. 1, No. 5, pp. 1–2.

1940: The smelt, *Osmerus mordax* (Mitchill). Mich. Dept. Cons., 13 pp.
1941: The age and growth of fresh-water fishes. Symposium on Hydrobiology, Univ. of Wis., pp. 196–205.
1942:
Brief résumé of the history of the changes in size of mesh employed in chub nets on Lake Michigan, particularly in Wisconsin waters. Wis. Cons. Dept., pp. 1–6.
The age and growth of the Lake Erie white bass, Lepibema chrysops (Rafinesque). Pap. Mich., Acad. Sci., Arts, and Lett., Vol. 27 (1941), pp. 307–334.
1942:
Relationship between the plantings of fry and production of whitefish in Lake Erie. Trans. Am. Fish. Soc., (1941), Vol. 71, pp. 118–121.
The Great Lakes fisheries: a review of the report of the International Board of Inquiry for the Great Lakes fisheries. State Gov't, Vol. 15, No. 11, pp. 211–212, 219–220.
The Great Lakes whitefish. Fading Trails, pp. 216–222.
1943:
United States-Canadian control urged to conserve Lake Erie fish supply. Clevelander, Vol. 17, No. 10, pp. 9–10, 24.
Lake trout. USFWS Fish. Leaflet No. 15, pp. 1–8.
Report of the President of the American Fisheries Society. Trans. Am. Fish. Soc., Vol. 72, pp. 13–14.
1944:
The great smelt mystery. Mich. Cons., Vol. 13, No. 6, p. 8.
Factors affecting the growth of fish. Trans. 9th N. A. Wildlife Conf., pp. 177–183.
1946:
The pike. Fish. Leaflet 166, pp. 1–6.
American Fisheries Society—its 75th anniversary. Trans. Am. Fish. Soc., Vol. 75, p. 13.
Maximum size and age of whitefish. The Fisherman, Vol. 14, No. 8, pp. 17–18.
1947: Mortality of smelt, *Osmerus mordax* (Mitchill), in Lakes Huron and Michigan during the fall and winter of 1942–1943. Trans. Am. Fish. Soc., Vol. 74 (1944), pp. 310–337.
1948: Turbidity as a factor in the decline of Great Lakes fishes with special reference to Lake Erie. Trans. Am. Fish. Soc., Vol. 75 (1945), pp. 281–322.
1949:
A definition of depletion of fish stocks. Trans. Am. Fish. Soc., Vol. 76 (1946), pp. 283–289.
Progress report on the sea lamprey studies. The Fisherman, Vol. 17, No. 3, pp. 6, 9, and 10.
The present status of the United States commercial fisheries of the Great Lakes. Trans. N. Am. Wildlife Conf., Vol. 14, pp. 319–330.
The sea lamprey—a threat to Great Lakes fisheries. State Gov't., Vol. 22, No. 12, pp. 283–284, and 289.
1950: Progress report on the study of Great Lakes trout. The Fisherman, Vol. 18, No. 5, pp. 5, 8, 9, and 10, and No. 6, pp. 5 and 8.

Van Oosten, John and Hilary J. Deason:
1938: The food of the lake trout (Cristivomer namaycush namaycush) and of the lawyer (Lota maculosa) of Lake Michigan. Trans. Am. Fish. Soc., Vol. 67 (1937), pp. 155–177.
1939: The age, growth, and feeding habits of the whitefish, *Coregonus clupeaformis* (Mitchill), of Lake Champlain. Trans. Am. Fish. Soc., Vol. 68 (1938), pp. 152–162.

Van Oosten, John, Hilary J. Deason, and Frank W. Jobes:
1934: A microprojection machine designed for the study of fish scales. Jour. du Conseil, Vol. 9, pp. 241–248.

Van Oosten, John, and Ralph Hile:
1949: Age and growth of the lake whitefish, *Coregonus clupeaformis* (Mitchill), in Lake Erie. Trans. Am. Fish. Soc., Vol. 77 (1947), pp. 178–249.

Van Oosten, John, Ralph Hile, and Frank W. Jobes:
1946: The whitefish fishery of Lakes Huron and Michigan with special reference to the deep-trap-net fishery. USFWS Fish. Bull., Vol. 50 (Bull 40), pp. 297–394.

Van Oosten, John and Walter Koelz:
1923: Preliminary report of investigations conducted in certain waters of Benzie, Leelanau, Grand Traverse, Antrim, and Charlevoix Counties during the months of July and August. Oct., 12 pp.
Van Oosten, John, Edw. Schneberger, E. Speaker, E. L. LeCompte, J. R. Simon, H. E. Warfel, T. H. Langlois, G. Bennett, and H. J. Deason:
1942: The administration of fishery programs. Trans. Am. Fish. Soc., Vol. 71 (1941), pp. 315–331.
Van Oosten, John, F. A. Westerman, W. C. Adams, and W. L. Finley:
1939: Migratory fish, a problem of interstate cooperation? Trans. 4th. N. Am. Wild. Conf., pp. 25–43.
Westerman, Fred A. and John Van Oosten:
1939: Report to the Michigan State Senate on the fisheries of Potagannissing Bay, Michigan. Mich. Dept. Cons., pp. 2–82.
Wright, Stillman:
1929: A preliminary report on the growth of the rock bass, *Ambloplites rupestris* (Rafinesque) in two lakes of northern Wisconsin. Trans. Wisc. Acad. Sci., Arts, and Lett., Vol. 24, pp. 581–595.
1932:
Conditions of life in lakes. Fisherman, Vol. 1, No. 8, pp. 3, 4, 12.
Plankton and the fisheries. Fisherman, Vol. 1, No. 7, pp. 3, 4, 11.
Pollution in Western Lake Erie. Fisherman, Vol. 1, No. 6, pp. 3, 4, 10.
1933: Summary of limnological investigations in Western Lake Erie in 1929 and 1930. Trans. Am. Fish. Soc., Vol. 63, pp. 271–285.

INVESTIGATION OF DECREASE OF FOOD FISHES AND RELATED STUDIES, FISH AND WILDLIFE SERVICE

The Bureau of Fisheries of the Department of Commerce was transferred to the Department of Interior about 1941 and became known as the Fish and Wildlife Service.

The amounts expended and obligated in the investigation of the decrease of food fishes and related matters since 1924, are listed below. These amounts were taken from the "Actual" columns of the "United States Budget."

Fiscal year—	*Expended and obligated*	Fiscal year—	*Expended and obligated*
1924	$39,029.71	1938	(1)
1925	38,116.85	1939	$348,230.00
1926	49,372.62	1940	424,888.00
1927	57,270.43	1941	424,789.00
1928	76,153.78	1942	423,947.00
1929	107,201.00	1943	(1)
1930	171,505.00	1944	470,034.00
1931	233,301.00	1945	525,977.00
1932	274,419.00	1946	561,950.00
1933	178,001.00	1947	794,037.00
1934	121,578.00	1948	805,816.00
1935	153,170.00	1949	1,189,135.00
1936	161,930.00	1950	1,779,066.00
1937	153,100.00		

[1] Not available.

(Whereupon, at 4:32 p. m., the committee adjourned.)